JOURNAL OF DAIRY SCIENCE

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Vol. XXX, No. 8, August, 1947

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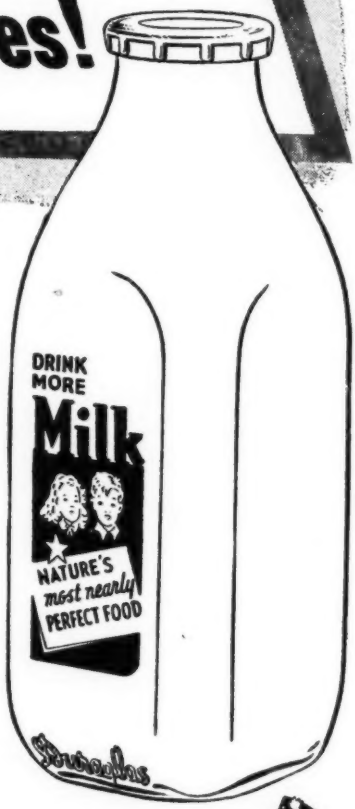

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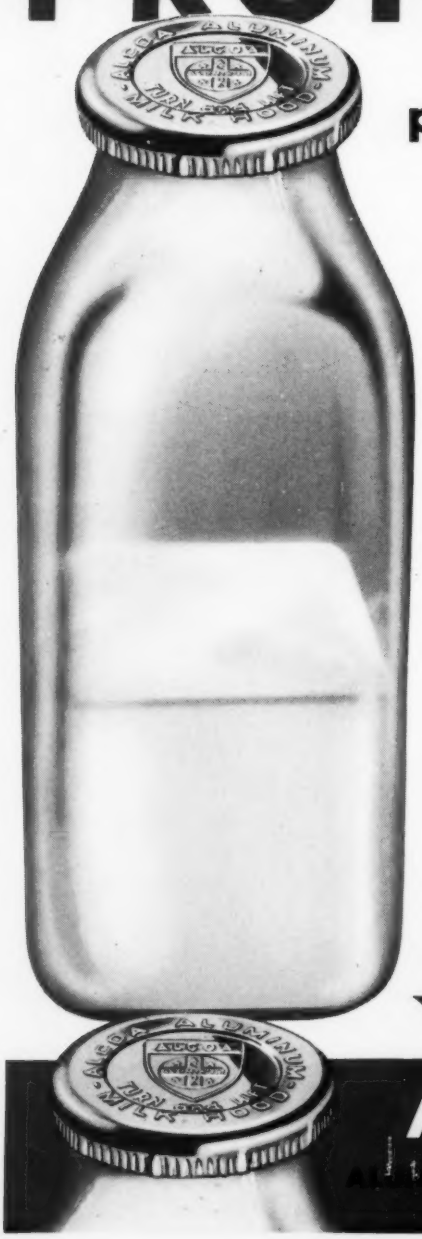

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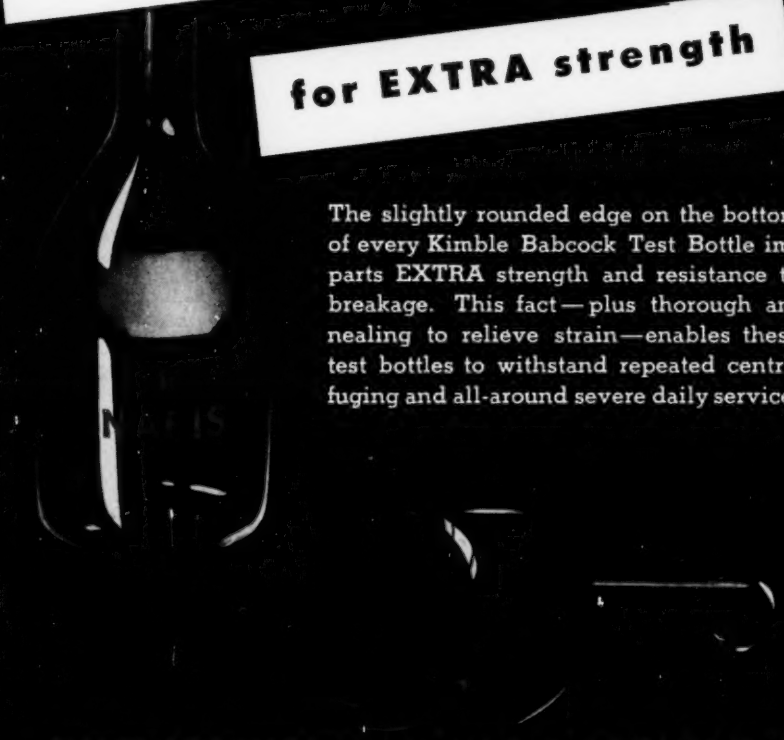

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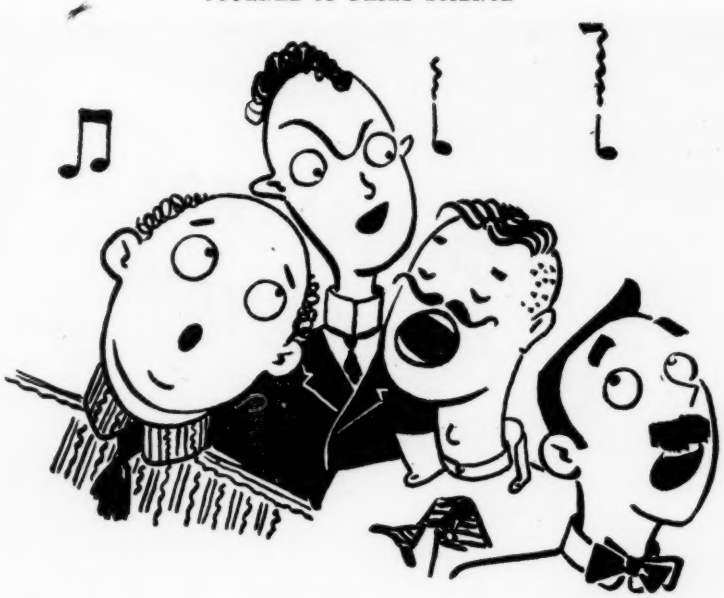

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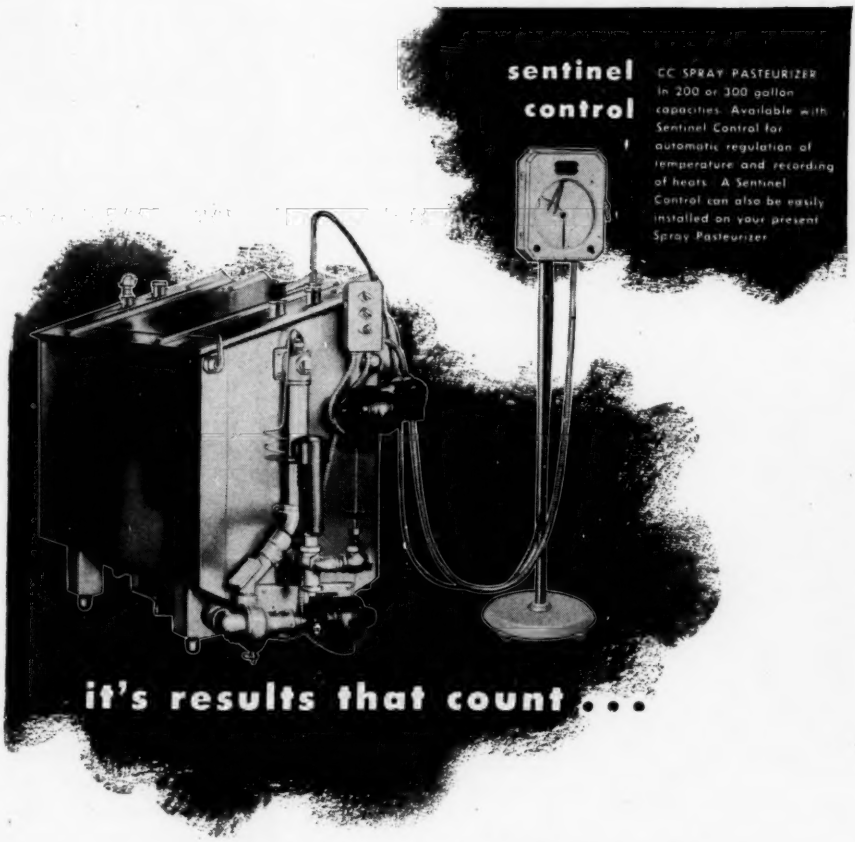
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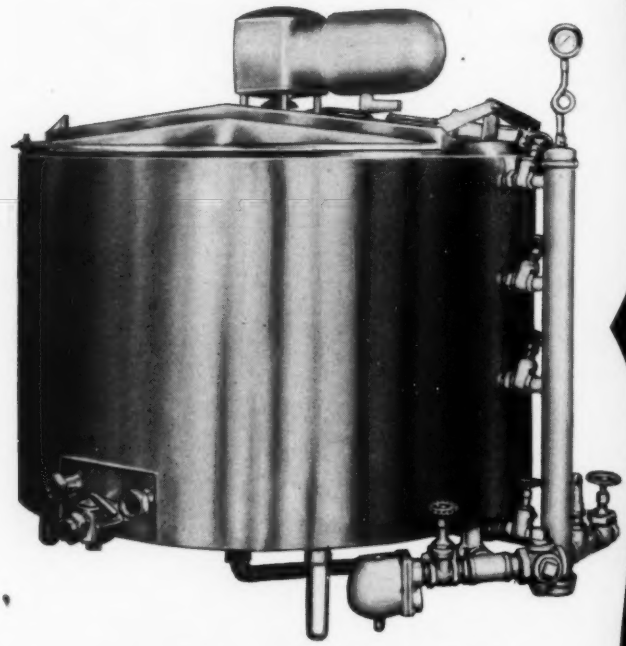

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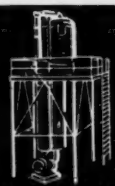
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JOURNAL OF DAIRY SCIENCE

VOLUME XXX AUGUST, 1947 NUMBER 8

ABSTRACTS OF PAPERS PRESENTED AT THE FORTY-SECOND ANNUAL MEETING

MANUFACTURING SECTION

M1 Application of the Phosphatase Test to Various Dairy Products.

GEORGE P. SANDERS AND OSCAR S. SAGER, Division of Dairy Research Laboratories, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

An improved modification of the phosphatase test, for application to Cheddar cheese and to fluid milk, was described by the writers in the November, 1946, issue of the JOURNAL OF DAIRY SCIENCE. As a result of further research, this test recently has been found reliable for detecting underpasteurization in cream, ice cream, sherbet, chocolate drink, butter, sweet buttermilk, cultured buttermilk, most of the principal varieties and kinds of cheese, and cheese whey.

The chemical principles of the test are the same for all dairy products. The optimal pH for the activity of the enzyme in the test has been found to be 10.0 to 10.05, and the optimal pH for development of indophenol blue color with a minimum of off-color interference has been found to be 9.3 to 9.4. Some of the different products have different buffering capacities, and the buffering capacities of the various cheeses increase during curing. Modifications, therefore, have been made in the concentration of the barium borate-hydroxide buffer to provide optimal enzymic activity in testing each product. Corresponding modifications have been made in the type and concentration of the zinc or zinc-copper protein precipitant in order to yield clear filtrates, promote complete color development, and minimize off-color interference.

The test is more sensitive than earlier tests and, by means of a dilution method used in developing and determining the amount of blue color, has been made quantitative for all the dairy products mentioned.

Production of phosphatase by microorganisms growing on the surface of some soft and semi-soft ripened cheeses—*e.g.*, Limburger, Liederkranz, and Camembert—has been encountered and this complicates an evaluation of the results of pasteurization. In most of these instances this effect has not been great enough to cause "false positive" results when the samples

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have been taken carefully from the center of the cheese by a method especially designed to prevent contamination of the sample. To date, no "false positives" have been encountered in testing samples of cream and butter in storage. All tested samples of process cheese and spreads made commercially have been found to be negative.

M2 Time-temperature Conditions Required to Inactivate Phosphatase in Different Dairy Products. GEORGE P. SANDERS AND OSCAR S. SAGER, Division of Dairy Research Laboratories, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

A laboratory pasteurizer was used, comprising a metal coil 30 feet long and $\frac{1}{8}$-inch internal diameter with a metal holding chamber at the end. The coil was immersed in a water bath, the temperature of which was controlled thermostatically with a variation not greater than $\pm$ 0.1° F. In heating fluid products, a 25-ml. sample was forced into the coil under pressure. The temperature of the sample increased to that of the bath in not more than 4 seconds. The holding time at the bath temperature was controlled with an error not greater than $\pm$ 3 seconds. Cheese samples (3 g.) were ground and placed in heat-sealing metal foil envelopes, which were squeezed to a thickness of 1 mm., sealed, and immersed in the bath. The time required for the temperature of the sample to reach that of the bath at 150° F. was not more than 18 seconds, as determined with a thermocouple.

Phosphatase test data for samples heated at any specific temperature for various periods of time show that the rate of destruction of the enzyme by heat is very rapid at first and diminishes to a relatively very slow rate with time. The experimental data for phosphatase destruction show that, in tests on milk and other fluid dairy products, a straight line results when the logarithms of the times of heating are plotted against the corresponding temperatures.

Holding periods required in this test to reduce phosphatase activity to two units per 0.5 ml. of whole milk were: 37 minutes at 143°, 30 minutes at 143.6°, 24 seconds at 160°, and 15 seconds at 161.7° F., respectively. The temperature required to produce a negative phosphatase test in any given time generally was found to be about 0.7° lower for skim milk than for whole milk, about 0.7° higher for 20 and 40 per cent cream than for whole milk, about 4.5° higher for ice cream mix than for whole milk, and about 5.7° higher for sherbet than for whole milk. The time required, at 143° F., was about three times as long for ice cream mix as for whole milk.

Results of a large number of tests on milks heated under controlled conditions and on cheese made from milks similarly heated indicate that maximal values of two units per 0.5 ml. for milk and three units per 0.25 g. for most kinds of cheese are suitable as criteria for pasteurization. Phosphatase

was inactivated at considerably lower temperatures and shorter holding times in Cheddar cheese than in milk—*e.g.*, at 130° F. in 13 minutes and at 140° F. in slightly less than 0.5 minute in cheese at pH 5.29. Mixing alkalies with the cheese to increase the pH had some effect in stabilizing the enzyme against heat. Adding emulsifiers had a greater effect, as the temperature required to produce a negative test in approximately 0.5 minute was 150° F. when 1.5 per cent anhydrous disodium phosphate was added and the pH of the mixture was 5.56.

M3 Determining the Germicidal Potency of Quaternary Ammonium Compounds and Their Use in Dairy Sanitation. W. S. MUELLER, D. B. SEELEY, AND E. P. LARKIN, University of Massachusetts.

A procedure for evaluating the germicidal properties of quaternary ammonium compounds is given. While the method basically is not new, it involves the use of newer procedures, such as the use of a hand homogenizer and the spectrophotometer. This method appears to give a truer picture of the germicidal potency under actual working conditions than is given by the phenol coefficient values as determined by the Food and Drug Administration method.

Organisms like *Escherichia coli, Staphylococcus aureus,* thermophilic types, and the vegetative cells of *Bacillus cereus* readily were killed by quaternaries. While quaternaries appeared to have no greater germicidal effect on spores of *B. cereus* and thermoduric types than older types of germicides, they were highly bacteriostatic to sporeformers.

Approximately 0.3 per cent of either cow manure or nonfat milk solids produced the first significant decrease in germicidal potency of a 200 p.p.m. quaternary solution. When this concentration of quaternary was used as an udder wash under normal conditions, approximately 30 to 40 cows could be washed before the germicidal potency of the solution decreased to a point where a fresh solution was needed. No chapping or cracking of udders, teats, or milkers' hands was noted when this concentration of quaternary was used.

Metal parts of dairy equipment, when properly washed, were effectively sanitized by the use of 200 p.p.m. of quaternary. However, as much as 400 p.p.m. was not effective in sanitizing the rubber inflation tubes of teat cups between each cow milked when the cups were dipped rapidly in and out of the solution. A quaternary spray treatment for milk cans showed a significant reduction in counts. Dual-purpose powders such as cleaner-sanitizer combinations appear to have considerable merit.

M4 Effectiveness of Hypochlorite and Quaternary Ammonium Germicides in Destroying *Streptococcus agalactiae* in a Mastitis Sani-

tation Procedure. K. R. SPURGEON, P. R. ELLIKER, W. J. HARPER, AND J. R. FROEDGE, Department of Dairy Husbandry, Purdue University.

A study was made of the comparative bactericidal activity, in various concentrations, of a number of germicides representing both hypochlorite and quaternary ammonium compounds. The most rapidly acting sodium hypochlorite and quaternary ammonium compounds were selected for further comparison of effectiveness in destroying *Streptococcus agalactiae* on teats and *Str. agalactiae* and *Staphylococcus aureus* on milking machine teat cups. Preliminary trials with inhibitors to stop germicidal action after prescribed periods of exposure indicated that sterile skim milk effectively neutralized the small residual of germicide remaining in experiments with teats and teat cups with both types of compounds.

Germicides applied to teats which had been inoculated with a suspension of *Str. agalactiae* did not eliminate all organisms present, but did destroy about 90 per cent of those that would have remained after ordinary rinsing of the teats with a non-germicidal solution. There was no pronounced difference in the effectiveness of the two types of germicides. Effectiveness of germicides was reduced markedly when old teat cups with surface breaks and cracks were used. *Staph. aureus* exhibited definitely greater resistance to both types of germicides than *Str. agalactiae* when inoculated onto teat cups.

The effectiveness of both germicides was increased by prerinsing teat cups in water to remove organic matter before treating with germicidal solution. The rinsing effect of the germicidal solution also removed large numbers of organisms from teat cups. Dipping teat cups in a germicidal solution at 51.7° C. was slightly more effective than dipping in a solution at 21.1° C.

Because of the possibility of contaminating teat cups from the rinse water commonly used to remove milk solids before dipping them in a germicidal solution, trials were carried out to determine the advantage of using a germicidal solution for this prerinse. Successive dipping in two germicidal solutions in most cases was more effective in destroying organisms on teat cups than dipping in plain water followed by a germicidal solution.

When the numbers of *Str. agalactiae* in sterile milk inoculated onto teat cups were high, (*e.g.*, more than 200 per teat cup), a number of cells usually survived successive dipping of the teat cups in a germicidal solution at 21.1° C., followed by one at 51.7° C. However, when the number of organisms inoculated onto teat cups was low (*e.g.*, less than 50 per teat cup), it usually was not possible to recover *Str. agalactiae* by means of sterile swabs after teat cups were treated with two successive dippings of either hypochlorite or quaternary ammonium germicidal solution.

M5 The Resazurin Reductase Test Using Prepared Sterile Dry Vials. N. S. GOLDING, State College of Washington.

The use of the resazurin reductase test for the bacterial quality of milk has increased steadily in recent years. Its great advantage over the methylene blue test is its greater flexibility and speed. The operation of the resazurin test in a factory where no trained bacteriological worker is available meets with certain difficulties associated not with the basic principle of the test but rather with its operation.

By experimentation a method using 3-dr. screwcapped vials, each containing 0.05 mg. of dry resazurin, was developed to overcome most of the objections to the mechanics of the test under plant conditions. The method of preparing the vials is as follows: (a) Arrange the clean 3-dr. vials in shelf metal trays 10 vials wide. (b) Sterilize in steam at 15 lb. for 5 minutes. (c) With a dispenser consisting of 10 1-ml. hypodermic syringes, fill 10 vials at a time with 1 ml. each of a 0.005 per cent resazurin solution prepared with sterile distilled water. (d) Return the trays to the autoclave and sterilize at 5 lb. steam pressure for 5 minutes. (e) Change valves on autoclave to operate as a vacuum drying oven, and inspect the vials in each tray over a white surface. (f) Complete the drying in vacuum and allow the vials to cool. (g) Cap with dry sterile caps and pack 1 gross per box.

The capped vials containing sterile dried resazurin have been kept more than 6 months and may be used at any time during that period. Any deterioration of the resazurin in these vials has not been noted and even considerable exposure to light does not appear to affect the resazurin. Using a modified rack for the vials, a Marschall methylene blue constant temperature water bath, and a suitable sampling dipper, all the resazurin test is done directly on the receiving platform as the milk is received.

It is not claimed that the resazurin test using prepared sterile dry vials is in any way basically different from the widely used standard method for operating this test. However, after using vials containing dry sterile resazurin in a factory during the last 2 years, it definitely is concluded that the method is rapid, sound, and economical, and gives more uniform results. Where operators of the test have little or no bacteriological and chemical training, the results still should be reliable.

M6 Some Observations on the Inversion of Sucrose by Invertase. L. E. MULL AND L. R. ARRINGTON, Florida Agricultural Experiment Station.

An experiment was conducted to determine some of the factors affecting the inversion of sucrose by invertase. The variable factors studied were concentration of sucrose solution, pH of sucrose solution, concentration of enzyme, temperature, and time required for inversion. The effects of these

factors were measured by determining the amount of sucrose inverted. In order to ascertain whether or not these factors might affect the amount of dextrose and levulose formed, the percentage of each of these also was determined.

Sucrose solutions at concentrations of 55 and 65 per cent were acted upon by invertase concentrations of 15, 20, 30, and 40 mg. per 1,000 g. of sucrose for periods up to 156 hours. The pH values tried were approximately 3.5, 4.5, 5.5, and 6.5. The temperatures employed were 45, 55, and 65° C.

From the data obtained, the following observations were made: (a) The sucrose concentration of 55 per cent was inverted at a more rapid rate than the concentration of 65 per cent. (b) Hydrogen-ion concentration in the range of pH 4.5–5.5 permitted the most rapid inversion, while at pH 3.5 inversion progressed more slowly and the rate of inversion was slowest at pH 6.5. (c) The rate of inversion increased proportionately as enzyme concentrations were increased from 15 to 40 mg. per 1,000 g. of sucrose. (d) The optimum temperature for inversion appeared to vary with pH. At 65° C. pH 4.5–5.5 resulted in the most rapid rate of inversion. (e) Inversion was most rapid during the first portion of the inversion period and steadily declined as inversion continued. Inversion was not considered complete until about 156 hours. (f) The ratio of dextrose to levulose varied very little from 1.2 to 1.

M7 Observations on the Microscopic Analysis of Raw and Pasteurized Milk. G. H. Watrous, Jr. and F. J. Doan, Department of Dairy Husbandry, Pennsylvania State College.

Bacterial clump counts obtained with a modified microscopic procedure and an altered stain and staining technique were compared with standard plate counts, using 32° F. incubation, on 406 samples of milk before and after laboratory pasteurization. The samples studied represented producers shipments as received at a milk plant during all seasons of the year. The direct microscopic modifications consisted of the use of less methylene blue and acetic acid in Newman-Lampert formula no. 2 stain, coupled with slight changes in the preparation of the stained smear, and the use of a "strip counting" technique similar to that advocated by Levowitz. With these alterations, more certain recognition and counting of bacteria and bacterial clumps was possible.

With raw milk the results obtained indicate a relationship approaching a 1:1 ratio between bacteria counts obtained with this direct microscopic procedure and the standard plate method, the correlation being closer and more definite with high count milk than with low count milk, as would be expected.

There is no significant relationship between the microscopic clump count employed and the standard plate count of bacteria in fresh laboratory-

pasteurized milk. Non-viable organisms apparently are capable of stain retention to a varying degree, undoubtedly influenced by the microflora of the individual sample.

Microscopic clump counts on fresh laboratory-pasteurized milk are considerably lower than those obtained prior to pasteurization, indicating that many cells destroyed by pasteurization are not capable of being stained. Little correlation exists between these counts on low count milk samples, but the relationship improves as the bacterial population increases. In practically all cases where the microscopic count of the raw milk sample is objectionably high, a similar count after pasteurization also is higher than can be considered satisfactory, indicating that the microscopic analysis of pasteurized milk, by the procedures used, has value in detecting bacterial inferiority in the raw milk used for pasteurization.

M8 An Activity Test for Cheddar and Cottage Cheese Starters. B. E. HORRALL AND P. R. ELLIKER, Department of Dairy Husbandry, Purdue University.

Studies on slow acid development in the manufacture of Cheddar cheese demonstrated the necessity in a plant starter program for a simple, accurate test to determine the activity of starter cultures under conditions simulating those in the cheese vat. The following method was developed to fulfill these requirements under practical conditions.

The milk was prepared by reconstituting high grade, spray-dried, nonfat milk solids in distilled water at the rate of 10 g. of milk solids per 90 ml. of water. This milk was sterilized in Erlenmeyer flasks at 15 lb. pressure for 10 min. Ten-milliter quantities of the reconstituted skim milk were pipetted into sterile screw-top test tubes and adjusted to 37.7° C. in a water bath. Each tube was inoculated with 0.3 ml. of the starter culture to be tested and incubated at 37.7° C. for 3.5 hr. At the end of the incubation period the entire contents of the tube, together with 5 ml. of distilled water used to rinse the tube, were titrated with tenth normal sodium hydroxide to a faint pink color, using phenolphthalein as indicator. The results were recorded as per cent lactic acid. This figure was termed the activity factor of the culture.

The data obtained indicated that in most cases low activity in starter cultures could be detected by this method before it became evident in the form of slow acid development in the cheese vat. Starter cultures that developed sufficient acid to yield a titratable acidity of 0.40 per cent or higher in the activity test resulted in cultures that were active in the cheese vat, providing bacteriophage, overheating in the vat, poor milk quality, or other abnormal factors were eliminated. Starter cultures with an activity factor of 0.30 to 0.35 were found to develop acid very slowly in the cheese vat.

A starter with an activity factor of less than 0.30 invariably developed little or no acid during the cheese manufacturing process.

This test or an earlier modification of it has been used daily for more than 2 years in four plants and for lesser periods in several others. It has proved a valuable aid in reducing incidence of slow acid production in the Cheddar cheesemaking process.

M9 Special Cultures for Manufacture of Blue Cheese from Pasteurized Milk. C. E. PARMELEE AND F. E. NELSON, Dairy Industry Section, Iowa Agricultural Experiment Station.

A study was made of some possible means by which Blue cheese could be made from pasteurized milk and still develop the flavor characteristic of Blue cheese made from raw milk.

The addition of cultures of the lipolytic organisms *Achromobacter lipolyticum, Alcaligenes lipolyticus,* and *Pseudomonas fragi* to milk did not increase fat breakdown and flavor development in Blue cheese but sometimes resulted in unnatural, musty, and unclean flavors. Cultures of *Mycotorula lipolytica* added to pasteurized milk increased fat hydrolysis and improved the flavor of Blue cheese. The amount of improvement varied with different strains of the organism.

Eight strains of mold of the *Penicillium roqueforti* type were used in Blue cheese made from pasteurized milk. No strain was found to be especially suited to that type of cheese.

A mold-enzyme preparation, made by the growth of *P. roqueforti* on a modified Czapek's medium low in carbohydrate and high in butterfat, was added to the milk for Blue cheese. From 0.05 to 0.25 per cent of the preparation resulted in a desirable level of fat hydrolysis and flavor development in the cheese after curing for 12 weeks. Some strains of mold were more suitable for making this preparation than were others.

Total volatile acidity was found to be quite closely correlated to flavor score of the cheese. Cheese with total volatile acidities in the range in which 30 to 55 ml. of 0.1 *N* sodium hydroxide were necessary to titrate the volatile acids in the first 1,000 ml. of steam distillate from 200 g. of cheese generally had the highest flavor score.

M10 Lipase Production by *Mycotorula lipolytica*. I. I. PETERS AND F. E. NELSON, Dairy Industry Section, Iowa Agricultural Experiment Station.

The production of lipase by *M. lipolytica* was enhanced by growing the organism at 30° C. in nutrient broth containing 0.05 per cent glucose and buffered at pH 4.5 with disodium phosphate and citric acid (0.225m).

Lipase activity was determined by adding 1 ml. of culture or cell-free filtrate to 50 ml. of an emulsion of 5 per cent butterfat in 0.25 per cent agar (containing 1:1500 formaldehyde) and incubating at 37° C. for 48 hours. To a 10-g. portion of incubated emulsion was added 25 ml. of neutral 95 per cent ethyl alcohol and 25 ml. diethyl ether, and the mixture titrated with *N*/20 potassium hydroxide in methyl alcohol, using phenophthalein as indicator. The lipase activity was expressed in acid degrees.

The yeast lipase was active over the pH range from 4.0 to 8.0, with the optimum at pH 6.2–6.5. When incubation periods extended beyond 48 hours, incubation temperatures of 28–33° C. resulted in greatest activity. Higher incubation temperatures resulted in a gradual inactivation of the enzyme, which was very pronounced at 48° C. and above.

The lipase-active substance was concentrated successfully by lyophilizing the culture, by use of the foam-adsorption procedure at pH 4.0, and by salting out with saturated ammonium sulfate. Salting out at 5° C. resulted in a more active precipitate than at 25° C.

Blue cheese made from pasteurized, homogenized milk to which was added cell-free filtrate of 2-day-old cultures resulted in greater fat hydrolysis and better cheese flavor than the uninoculated control. Lipase added in quantities to give volatile acidity titration values of 40–50 ml. *N*/10 sodium hydroxide per 200 g. of steam-distilled 12-week-old cheese was found most satisfactory. Higher values resulted in an excessively sharp and soapy taste.

The lipase of *M. lipolytica* offers possibilities for use in the production of Blue cheese from pasteurized milk.

M11 The Vapor Pressure-Moisture Relationships of Dry Milk Products.
R. W. KUNKEL AND S. T. COULTER, Dairy Division, University of Minnesota.

The water content-relative vapor pressure relationships of dry milk solids-not-fat, dry whole milk, dry ice cream mix, and various spray dried systems of milk constituents were studied. The relative vapor pressure of water over these products plotted against the water content gives S-shaped sorption isotherms such as are typical of a wide variety of materials.

Other work at this Station has demonstrated certain relationships that exist between the water content and the rates of deterioration during storage of dry whole milk and dry ice cream mix. Correlation of these data with data obtained on relative vapor pressure demonstrates that the log of the rate of reaction, with respect to the production of acid ferricyanide reducing substances and carbon dioxide, is a straight line function of the relative vapor pressure.

M12 Some Factors Influencing Spray Drier Design and Operation. ARNOLD KITZES AND S. T. COULTER, Dairy Division, University of Minnesota.

Data showing the relationship between the humidity of the inlet air to the drier and the moisture content of the powder have been secured. The moisture content of the powder increases with increase in the inlet air humidity at any given rate of milk feed. The capacity of a drier to produce powder of a given moisture content is influenced materially by the humidity of the inlet air.

The vapor pressure-moisture relationships of dry milk at various temperatures have been determined. Attempts have been made to ascertain the drying rate of the milk particle. Data available at present indicate that the vapor pressure of the exit air from the drier always is lower than that of the water associated with the milk powder particle.

M13 Changes Produced in Milk on Heating. H. A. HARLAND, R. JENNESS, AND S. T. COULTER, Divisions of Dairy Husbandry and Agricultural Biochemistry, University of Minnesota.

The effect of relatively long-time, high-temperature treatment of milk and milk components on the color and chemical properties has been studied in an attempt to elucidate the mechanism of the browning reaction of milk products.

Systems included in this work, in addition to skim milk, were buffered aqueous systems of lactose, caseinate, serum proteins, lactose-caseinate, lactose-serum proteins, lactose-caseinate-serum proteins, and caseinate-serum proteins. The heat treatments consisted of refluxing the systems in an oil bath. Aliquots were taken for analysis initially and after 1, 3, 6, and 12 hours of heating. The following determinations were made on the heated materials: lactose polarimetrically and by two reducing methods, acid ferricyanide reducing substance, pH, amino nitrogen, and fluorescence.

There was a lack of agreement among the methods for lactose when used on the heated products. Large losses of lactose were observed polarimetrically and small losses by the chloramine-T method. Values higher than the initial ones were obtained with the alkaline ferricyanide method.

The heat treatments resulted in small increases in the acid ferricyanide reducing substances of caseinate systems, but in very much larger increases when lactose was present. High reducing values are characteristic of those systems having a brown color. Thiamin disulfide reducing substances were highest in systems containing only proteins. Lactose containing systems yielded little or none of these substances.

Decomposition of lactose largely is responsible for the gradual decrease in pH of milk during heat treatment.

The amino nitrogen of systems containing serum proteins in the absence of caseinate decreased with heat treatment. There was no change in amino nitrogen in systems containing caseinate and lactose, but heating caseinate and buffer in absence of lactose resulted in a definite increase in amino nitrogen.

Heat treatment of lactose or caseinate systems resulted in increases in fluorescence of an acetone-water extract; much larger increases in fluorescence were observed on similar extracts of lactose-caseinate systems. Ten per cent KCl extracts of protein systems indicated the development of fluorescent substances during heat treatment.

The colors developed by the systems during heat treatment were recorded photographically. All of the systems containing lactose showed some degree of browning. Lactose-caseinate systems were of the darkest color, while caseinate alone acquired a slight but definite pink coloration. Serum proteins appear to have little effect on the formation of brown color in milk.

M14 Some Changes in Dry Whole Milk during Storage. R. JENNESS, S. T. COULTER, H. A. HARLAND, AND L. K. CROWE, Divisions of Agricultural Biochemistry and Dairy Husbandry, University of Minnesota.

The effects of storage on dry whole milk have been studied in experiments designed to differentiate the respective rôles of temperature, oxygen level, and moisture level. Further experiments have been made on storage of dried simplified systems of milk constituents in an effort to determine which of them participate in the reactions that occur during storage. The progress of the deteriorative processes was followed by measurements of flavor, solubility, reducing capacity, fluorescence, browning, carbon dioxide production, oxygen utilization, and the concentrations of hydrogen ions, lactose, and amino nitrogen.

In addition to the tallowy flavor which develops only in the presence of adequate supplies of oxygen, two distinct stale flavors developing in gas-packed powder at different moisture levels have been observed. For a given powder at constant temperature, a linear relation holds between the log of rate of over-all loss of flavor score and moisture content. This rate differs from powder to powder and is accelerated greatly by increasing the storage temperature. The rates of change of solubility, reducing capacity (to acid ferricyanide), fluorescence, browning, carbon dioxide production, pH, and lactose concentration all are dependent on moisture level and temperature but not on oxygen level. Indications are that the reactions producing these changes involve lactose and protein. While considerable decreases in lactose concentration (as determined polarimetrically) occur during storage, particularly at high temperature and high moisture, no loss in amino nitrogen was found under the same conditions.

M15 The Relation of Ascorbic Acid to the Keeping Quality of Dry Whole Milk. S. T. COULTER AND R. JENNESS, Divisions of Dairy Husbandry and Agricultural Biochemistry, University of Minnesota.

Ascorbic acid has been reported to be an essential link in the chain of reactions by which oxidized flavors develop in liquid milk. The rôle of ascorbic acid in the loss in flavor quality of dry whole milk has been investigated, using simplified systems as well as spray-dried whole milk. The simplified systems consisted of spray-dried mixtures of calcium phosphocaseinate and butterfat, both with and without ascorbic acid. In each of eight different trials a quantity of whole milk was split into three lots, one of which served as the control. In the second lot sufficient hydrogen peroxide was added before preheating to oxidize the ascorbic acid, and in the third lot the ascorbic acid was oxidized with hydrogen peroxide before preheating and 16 mg. of ascorbic acid per 100 g. of solids added to the milk after preheating. All lots were condensed in stainless steel equipment and then spray dried. The preheating was at each of the following temperatures for two trials: 63, 68, 74, and 79° C.

Tallowiness developed at an earlier date in the air-packed simplified systems containing ascorbic acid and became more intense than in those not containing ascorbic acid. Tallowiness did not develop in the nitrogen-packed simplified systems. The air-packed control samples of dry whole milk deteriorated in flavor quality at a significantly faster rate than the samples from which the ascorbic acid had been oxidized prior to preheating. There was no significant difference in the rates of flavor deterioration of the samples from which the ascorbic acid had been oxidized and those to which ascorbic acid was added after preheating. All of the air-packed samples after 12 weeks of storage at 37° C. had a tallowy flavor to a greater or less degree. The nitrogen-packed samples showed no significant differences in keeping quality, none being judged tallowy after 12 weeks of storage at 37° C.

M16 Factors Affecting the Ease of Reconstitution of Milk Powders. U. S. ASHWORTH AND H. A. BENDIXEN, Washington Agricultural Experiment Stations.

The ease of dispersion of whole milk powder is an important consideration to the consumer. A good whole milk powder was found to disperse completely to a concentration of 12.5 per cent total solids at a temperature of 68° F., with 20 back-and-forth excursions of about 1 foot during a period of 7 seconds. The physical state of the casein is the factor limiting the rate of dispersion. Precondensing to 40 per cent total solids before spray drying produced a powder which redispersed much more rapidly than did one made

from the same milk precondensed to 20 per cent total solids. Preheating temperatures of 160 to 180° F. for periods of 10 minutes had no appreciable effect on the rate of dispersion of the powders.

Increasing the temperature of the water increased the rate of dispersion up to a certain temperature and then caused it to decrease. Apparently this decrease is caused by denaturing action of the warm water on the casein. Consequently, there is an optimum temperature of reconstitution. The effect of manufacturing methods on this optimum temperature will be presented.

Contact with water at 68° F. for periods up to 15 minutes adversely affects the reconstitution rate for the most rapidly dispersible powders. The amount of undispersed residue left after 7 seconds of manual shaking is approximately proportional to the time of standing in contact with water before agitation. Increasing the temperature of the water held in contact with the powder decreases the rate of dispersion.

M17 The Use of Nonfat Dry Milk Solids for Mother and Batch Starters. B. E. HORRALL AND P. R. ELLIKER, Department of Dairy Husbandry, Purdue University.

Preliminary investigations on slow acid development in Cheddar cheese manufacture indicated that starter cultures varied in activity from day to day even though the milk used for the cultures was obtained from the same herd. Trials were carried out to compare uniformity and activity of *Streptococcus lactis* cheese cultures propagated in selected herd milk with reconstituted skim milk prepared from representative lots of high grade, spray, nonfat dry milk solids. The reconstituted skim milk contained 10 per cent milk solids.

Cultures carried in the reconstituted skim milk were more uniform in activity from day to day than duplicate cultures carried in the selected herd milk. Single and multiple strain mother and batch cultures have been propagated successfully in reconstituted skim milk for more than 2 years. In order to assure a milk satisfactory for growth and activity of starter cultures, it was found necessary to test each barrel of nonfat dry milk powder. The source of the water used in reconstituting the skim milk significantly influenced the activity of the cultures. The use of distilled water consistently yielded a satisfactory milk. Certain city and plant water supplies consistently yielded milks that failed to provide active cultures.

M18 Influence of the Per Cent Oxygen in the Headspace Gas of Container on the Quality of Dry Whole Milk during Storage for One Year. G. H. WILSTER, Oregon State College.

This report covers one phase of a research project that involved the

manufacture, storage, and rehydration of dry whole milk. The method of manufacture consisted of: (a) heating the standardized milk, which previously had been clarified centrifugally, in a stainless steel pasteurizer for about 45 to 50 minutes to a temperature to 170° F. and holding at this temperature for 30 minutes; (b) cooling the milk to 145° F.; (c) condensing to 3:1 concentration in a stainless steel vacuum pan 3 feet in diameter; (d) homogenizing at 1,500 lb. per square inch, first stage, and 500 lb. per square inch, second stage, at the temperature as obtained from the vacuum pan; (e) cooling on a stainless steel surface cooler to about 35° F.; (f) preheating the condensed milk in a 10-gallon capacity stainless steel tank; and, finally, (g) spray drying the condensed milk in a $6' \times 17' \times 9'$ chamber.

When packing, 155 g. dry milk were weighed into size no. 1 tin containers. The cans then were sealed. A total of 71 packs, usually 24 cans to each pack, was made. When evacuating and gassing, the punctured cans were placed in an evacuation chamber and evacuated and gassed as desired. Immediately after removing the cans from the chamber, they were soldered quickly. The samples of dry milk for all packs were stored for 1 year at a temperature of 80 to 90° F. The flavor of the reconstituted milk, per cent oxygen in the headspace gas of container, per cent carbon dioxide in headspace gas of container, solubility index, and ascorbic acid content of the freshly reconstituted milk were determined at monthly intervals. The data show that as the per cent oxygen in the headspace of the container was decreased, the keeping quality of the dry milk improved. The average score of the milk packed with less than 1 per cent oxygen at equilibrium was 1.44 higher at the end of the storage period than that of the milk packed with 3.04 to 3.50 per cent oxygen. The final score of the milk in the low-oxygen group, at the end of the 12-month storage period, was 18.09 and that of the high-oxygen milk was 16.97. This was based on a maximum score of 25 for flavor.

The influence of size of the dry milk particles on the keeping quality was studied with eight batches of powder. The average size of the milk particles ranged from 8.15 to 19.29 μ in diameter. When the 32 packs of powder were grouped in accordance with the amount of oxygen in the headspace of the container at equilibrium and the decreases in the flavor score were averaged, the coarser-grained powder was found to possess better keeping quality than the fine-grained powder.

M19 A Comparison of the Yields of Cheddar Cheese Obtained from Raw, Holder Pasteurized and High Short-Time Pasteurized Milk. O. R. IRVINE, L. R. BRYANT, D. C. HILL, AND W. H. SPROULE, Ontario Agricultural College.

In connection with some wartime research on the nutritional value of Cheddar cheese, an opportunity was afforded to secure data on yields of

cheese from milks receiving three types of treatment. The results of nine comparative trials are reported; in each trial approximately 1,800 lb. of carefully-mixed milk was divided into three lots. The first lot was made into raw milk cheese, the second was pasteurized to 143° F. for 30 minutes and then made into cheese, and the third lot was pasteurized at 161° F. for 16 seconds before manufacture.

Yields of the 1-day-old cheese from these vats were calculated in terms of 35 per cent moisture in order to eliminate this source of variation in the results. On this basis, the mean for the raw milk vats was 9.84 lb. of cheese per 100 lb. of milk, while the value for the holder pasteurized milk was 10.02 and for the high short-time pasteurized milk 10.01. Calculations based on determinations of the fat content of the milk and cheese reveal that 88.68 per cent of this constituent was retained in the case of the raw milk cheese, while the mean rates of butterfat retention were 90.15 and 91.13 per cent, respectively, for the holder and high short-time pasteurized milk. Fat determinations made on the wheys removed up to the time cheddaring of the curds was begun gave means which were approximately equal in the case of the raw and holder pasteurized milk cheese, but which were markedly lower in the case of the high short-time pasteurized milk cheese.

The data from which these values were derived were subject to statistical treatment by the analysis of variance method. No evidence exists that the yields of cheese per 100 lb. of milk are influenced by the different treatments which the milk received. However, the treatments did produce significant differences in the efficiency with which the butterfat was retained in the cheese as well as the rate at which butterfat was lost in the whey.

M20 A Study of the Volatile Acidity in Milk. P. G. MILLER, P. L. ZIMMERMAN, AND E. B. OBERG, Carnation Company, Milwaukee, Wisconsin.

Since the heat treatment of milk has been shown to increase volatile acidity, a study of the volatile acids in processed milk should aid in evaluating different sterilizing treatments. The best method for obtaining volatile acids from milk without producing more acids is subject to question. Steam distillation has been reported to produce no formic acid; however, it does release volatile sulfide(s). On the other hand, vacuum distillation does not appear to release volatile sulfides and thus may be expected to be less destructive of the milk constituents.

Steam distillation and vacuum (at 24 mm. Hg. and constant volume) distillation procedures were compared on the basis of rate of distillation of formic acid and of *n*-butyric acid, the recovery of added formic acid, total volatile acidity in the distillates, and other factors. Some vacuum distillation results are presented showing the relation of sterilization treatment of

evaporated milk to development of total volatile acidity, formic acid, and color.

The rate of distillation of formic acid was slightly greater with steam than with vacuum. By either method approximately 30 per cent of the formic acid was distilled when the volume of the distillate equaled the volume of the distilland. The rate of distillation of *n*-butyric acid definitely was greater with steam than with vacuum. With steam distillation the recovery was about 87 per cent and with vacuum distillation about 53 per cent, when the volume of the distillate equaled the volume of the distilland. Steam and vacuum distillations gave about the same recovery for added formic acid (gravimetric method).

Steam distillation of milk gave higher values for total volatile acidity than did vacuum distillation. The higher values with steam distillation appeared to be due to the evolution of CO_2 during the steam distillation and not to the more rapid distillation of acids such as butyric.

Steam distillation of an aqueous tributyrin suspension resulted in the hydrolysis of about 3.5 per cent of the triglyceride, whereas vacuum distillation showed no evidence of triglyceride hydrolysis. The total volatile acidity, formic acid, and color of evaporated milk varied directly with the degree of heat treatment.

M21 Some Unique Properties of Lactose as a Dietary Carbohydrate. LLOYD K. RIGGS AND ANNABEL BEATY, Kraft Foods Company, Chicago, Illinois.

Young rats weighing 50 to 60 g. were fed *ad libitum* purified diets containing 5 per cent fat in which USP lactose was substituted for cornstarch at levels of 5, 10, 15, 20, 25, 30, 40, and 50 per cent of the total ration. Feed consumption was recorded and the animals were weighed and observed for symptoms of lactose feeding three times each week for 12 weeks. Up to and including 30 per cent lactose, these rations equaled the basal ration (no lactose) in growth and food utilization. At the 40 and 50 per cent levels growth was less, and at 50 per cent food utilization was less efficient than on the basal ration.

Symptoms of lactose feeding, diarrhea and/or "pot-bellies", were observed first at the 20 per cent level and became progressively more severe and more persistent as the percentage of lactose in the ration was increased. The capacity of the rats to utilize lactose without suffering from diarrhea was increased through repeated daily intake of rations containing lactose.

By feeding rations containing a mixture of equal parts glucose and galactose at levels equivalent to 15, 30, and 50 per cent lactose, the lactose linkage was found responsible for the symptoms observed on rations containing higher percentages of lactose. At levels of 30 and 50 per cent,

growth was less and food utilization more efficient on the diets containing lactose than on the rations containing equivalent amounts of the mixture of the two simple sugars.

M22 The Relationship between the Oxidation of Ascorbic Acid and the Development of the Oxidized Flavor in Milk. GEORGE R. GREENBANK AND PHILIP A. WRIGHT, Division of Dairy Research Laboratories, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

In recent publications attempts have been made to revive the enzyme theory to explain the development of the oxidized flavor. A study has been made to determine whether the reaction which accompanies the development of an oxidized flavor in milk resembles an enzymatic or a chemical oxidation. The oxidation of ascorbic acid, a normal constituent of milk, has been considered by others as a link in the postulated oxidation of the lipid which causes the off flavor. Data are presented to show that the oxidation of ascorbic acid parallels the postulated oxidation of the lipid but is not necessarily a link in the oxidation chain and that the addition or destruction of ascorbic acid promotes changes which may be expected when reducing agents are added to a milk or removed from it. Many seemingly abnormal reactions observed by others upon the addition of ascorbic acid, copper, and hydrogen peroxide to a milk are clarified by the use of a simple equation to illustrate the chemical changes which occur during the development of the flavor.

M23 The Use of Carotene for Coloring Butter. G. A. RICHARDSON AND M. LOUISA LONG, University of California.

Color determinations on the fat from 132 butters manufactured in California and collected in connection with a national survey of the vitamin A activity of butter revealed a surprising lack of uniformity of coloring. The variation in carotene content was not compensated for, adequately, by added color.

The intensity of color in terms of optical density was determined on a 10 per cent (w/v) solution of the butter in gasoline, using a 1.6 cm. cell, a wave length of 440 mμ, a wave band of 35 mμ, 20° C., with a Model 11 Coleman spectrophotometer. It was found that 7.6 per cent of the samples fell in the optical density range of 0.15–0.20, 16.7 in the range 0.21–0.25, 28 within 0.26–0.30, 31.1 within 0.31–0.35, 13.6 within 0.36–0.40, and 3 per cent within 0.41–0.45. If carotene were the only color present, these ranges represent, respectively, carotene values of approximately 3,700–5,200, 5,500–6,700, 7,000–8,200, 8,500–9,600, 9,800–10,800, and 11,000–12,000 I.U. per lb. of butter.

Carotene is known to be prooxygenic in refined oils, especially at elevated temperatures. It was found to be moderately prooxygenic in butter oil prepared so as to be low in phospholipid, α-tocopherol, and other antioxidants. With milk fat as usually prepared in the laboratory, added carotene is not definitely prooxygenic at room temperature in the absence of direct sunlight. Added α-tocopherol or lecithin imparts some protection but is not as effective as nordihydroguaiaretic acid (NDGA) or quercetin. Carotene dissolved in the fraction of milk fat liquid at room temperature (approximately 68° F.) is more rapidly destroyed than when dissolved in either the complete fat or in the fraction that has crystallized out at or above room temperature.

In the initial experiments, a commercial carotene concentrate (from carrots) in Wesson oil was used as added color for laboratory churnings. The color characteristics were good, but flavor scores, especially after storage, were unfavorable. Refinements in the methods of extraction and isolation of carotene from carrots have made available carotene concentrates of little or no flavor or odor, and of potencies ranging from 5,000 to 8,800 I.U. per g. The stability of these concentrates is quite high. More than 50 per cent of the carotene remained after exposure to laboratory light and temperature conditions for 40 days. Quercetin and NDGA decreased the rate of destruction.

Several laboratory churnings were made from the same lot of cream, with and without added copper (2 p.p.m.) and with and without added carotene. Samples were stored at 18 and at 60° F. At the end of a 10-month storage period at 18° F. the peroxide values of all samples were fairly low (av. 1.56 me/kg., without copper; 2.19 me/kg., with copper). Added carotene, at this temperature, neither promoted nor inhibited peroxide accumulation.

At the end of 5 months of storage at 60° F., the peroxide values of the controls without added copper were less than 2.5. Added carotene was definitely prooxygenic for those without copper but appeared antioxygenic for the samples containing added copper. The color values of all samples not containing copper remained practically unchanged during the 5 months of storage.

Butters manufactured under commercial conditions and colored to different degrees with one of three commercial carotene concentrates are undergoing storage trials.

A simple method is described by which the tester may determine the color score of the fat to be churned and indicate to the buttermaker the amount of color to be added per 100 lb. of fat to give a predetermined shade to the butter.

M24 Graphic Procedure for Determining Quantitative Results of Volumetric Analysis. WAYNE I. TRETSVEN, Advisory Service, Chicago, Illinois.

A graphic procedure is described for rapidly and accurately determining the results of volumetric analysis. The tedious tasks of preparing solutions to a definite concentration (normality) or their standardization to normality factors, and all the calculations involved, are eliminated by substituting a simple graph. It is particularly useful when two or more solutions are required and is especially advantageous where one or both solutions are of such nature as to require frequent restandardization. The procedure has been adapted to various analyses and is explained in terms of a specific example. Since the method was developed and used extensively in the laboratory for determining the salt content of cheese, it is illustrated in terms of this application.

The principles of the procedure depend on establishing a line or lines portraying the actual titration values of the reagents. Only two points (titrations) are necessary. The points established represent an actual analysis and are based on a 100 per cent recovery. The construction of the graph is simple. If the scales of the graph are chosen suitably, *e.g.*, 1.0 division per 0.1 ml. solution or per 0.1 mg., the results will be as accurate as the burettes can be read. In actual use, no knowledge of the normalities of the solutions or any calculations are necessary.

M25 Some Chemical Reactions Involved in the Production of the Sunlight Flavor in Milk. D. G. KEENEY AND D. V. JOSEPHSON, Department of Dairy Technology, Ohio State University.

The sunlight flavor precursors are known to originate in the milk serum, although the reactive compounds involved in the photochemical changes have yet to be identified.

In order to ascertain the type of reaction involved in the production of the sunlight flavor, attempts were made to synthesize a similar flavor. By the addition of approximately 50 p.p.m. of formaldehyde before heating the milk to 75° C., a flavor was developed which was indistinguishable from that produced by exposing the same untreated milk to sunlight. Heat treatments below 75° C. resulted in no flavor change in formaldehyde-treated milks, while heating to 80–90° C. served to intensify the sunlight-type flavor development. The critical temperature for sunlight flavor development under these conditions coincides with that for the liberation of sulfhydryl compounds in normal heated milk. This would suggest that sulfhydryl compounds and aldehyde groupings are essential to the mechanism of the sunlight flavor development, possibly the formation of a mercaptal type compound. Substantiating evidence was furnished by the fact that in heating formaldehyde-treated milks the cooked flavor never developed, and free sulfhydryl compounds as indicated by the nitroprusside test were greatly diminished or absent.

The oxidation-reduction range and poise seem to play an important rôle in both the natural and synthetic development of the sunlight flavor.

When casein was removed from skim milk by rennet coagulation and the albumin subsequently eliminated by boiling and supercentrifuging at 35,000 r.p.m. for 0.5 hour, the resultant clear liquid upon exposure to sunlight developed the flavor to such an extent that it was still discernible upon dilution to ten times its volume with the original skim milk. The development of the flavor in this fraction always was accompanied by a definite increase in saltiness.

Upon dialysis of skim milk for 36 hours and subsequent exposure of the fraction to sunlight, no detectable sunlight flavor developed. When skim milk first was exposed and then dialyzed, the sunlight flavor of the non-dialyzable fraction showed a decrease far greater than could be attributed to dilution. In no case was a detectable sunlight flavor found in even the concentrated phase of the diffusate. This would suggest that the flavor compound either exists in a complex, all substituents of which are essential for the flavor, or that the flavor is sensitive to changes in the oxidation-reduction potential and had been destroyed by the dialytic action.

M26 A New Sensitive Method for Determining the Concentration of Quaternary Ammonium Germicide Solutions. W. J. HARPER AND P. R. ELLIKER, Department of Dairy Husbandry, Purdue University, AND W. K. MOSELEY, Moseley Laboratories, Inc., Indianapolis, Indiana.

An accurate, rapid, simple test for determining the concentration of quaternary ammonium germicides has been developed. The method is based on the formation of a red precipitate on addition of 1 ml. of quaternary ammonium solution to an equal volume of eosin-yellowish dye solution (0.01 per cent eosin-yellowish dissolved in acetone and the acetone solution diluted 1 : 10 in tetrachlorethane) in the presence of 0.1 ml. of pH 3.5 citric acid-NaOH buffer, and the subsequent titration to a colorless compound with a 0.01 per cent active anionic surface-active reagent. A standard curve may be established for a specific quaternary by using a pure compound of known concentration.

The method has been found satisfactory for determining the concentration of a number of different dilute quaternary ammonium solutions. It may be used either as a quantitative laboratory method or as a rapid field kit test. It also may be used to detect the quantity of quaternary ammonium germicides added to raw milk. A modification for estimating the concentration of quaternaries by the use of paper test strips has been developed.

M27 Ionic Exchangers in the Dairy Industry. O. F. GARRETT, M and R Dietetic Laboratories, Inc., Columbus, Ohio.

Ionic exchangers have been known and used in the dairy industry of the United States since the early 1930's when Lyman obtained a patent on a process for treating milk products. Lyman's process employs the base exchange principle, which is a type of ionic exchange, and is broad in its applications covering the treatment of milk, skim milk, whey, and the preparation of milk for evaporation, cheesemaking, etc. The development of new types of ionic exchanger materials in the last few years has stimulated experimental work looking toward the application of these materials to the processing of dairy products.

Experimental investigation of the application of ionic exchangers to the manufacture of various products from milk has been continuous in our laboratories beginning in 1932. The application of the base exchange principle to the preparation of soft curd milk is well known in the industry. In addition we have found that ionic exchanger materials may be applied to ice cream making, powdered whole milk, condensed milks, stabilized condensed and dried creams, lactose manufacture, and other specialized products.

M28 A Microscopic Study of Ice Cream Texture. W. S. ARBUCKLE, Animal Industry Department, Dairy Manufacturing Section, North Carolina State College.

The microscope is useful in determining certain body and texture characteristics of ice cream which are not readily detected organoleptically. The method used for routine examination includes the preparation of a thin section of ice cream, imbedding the section in an oil with a refractive index of 1.420 and examining with a microscope at a magnification of 100 times. Sectioning and examining are best done at a temperature of $-15°$ F. or lower.

Lithographed photomicrographs are included in this paper to illustrate the effect of type of freezer, heat shock, and other factors on the structure of ice cream.

M29 The Place of the Private Quality Control Laboratory in the Dairy Industry. M. A. COLLINS, Collins Dairy and Food Laboratories, Dryden, N. Y.

Factors to be considered in the establishment and operation of a private laboratory serving the dairy industry are discussed. Tests on the various dairy products, farm inspection, plant inspection, efficiency of plant operations, and personnel training are services which a laboratory of this type may offer.

M30 Newly Developed Cleaning Aids for the Dairy Industry. JOHN R. PERRY, Sealtest, Inc., New York, N. Y.

Devices recently developed by the author are designed to make possible better, more efficient, and more economical cleaning of dairy equipment and to make the cleaning job a desirable one instead of the distasteful one it so generally has been. Among the devices described are the shut-off valve for the end of the rinse hose, the sanitary fittings cleaner, the sanitary pipe cleaner, the separator disc cleaner, solution fed brushes, special brushes, and the power-driven solution fed brush.

M31 Some Observations on the Chemistry of Heat-induced Flavors in Milk. STUART PATTON AND DONALD V. JOSEPHSON, Ohio State University.

The heat-induced flavor changes occurring in heated skim milk were studied, using a group of five taste observers. The most important and pronounced changes resulting from the heat treatment were found to be the development of "cooked" (olfactory) and "rough" (tactual) flavors. These same flavors also were manifest to approximately the same degree in heated rennet whey.

In order to determine the importance of serum proteins in these flavor changes, heated (205° F.—flash) rennet whey was supercentrifuged at 35,000 r.p.m. Such treatment produced significant reductions in "cooked" as well as "rough" tactual flavor responses. Parallel diminution (in certain cases complete) in the nitroprusside test of the whey occurred as the result of the removal of denatured serum proteins. The primary importance of serum proteins in heat-induced flavor changes was demonstrated by these studies. Attempts to remove serum proteins from heated skim milk by supercentrifugation were unsuccessful, as indicated by the nitroprusside test and flavor responses of the observers to the skim milk following centrifuging treatment. This phenomenon may be attributed to the physical and/or chemical adsorption of serum proteins on the casein micelles in heated milk.

In studying the behavior of sulfhydryl groups in heated milk, it was found that the serum proteins (sulfhydryl positive) dispose themselves in the rennet curd of the milk rather than in the whey. Such a phenomenon may explain, in part, the soft curd characteristics of highly heated milk. The close physico-chemical relationship existing between serum proteins and casein in heated milk also is demonstrated.

When samples of skim milk were heated for prolonged periods at 205° F., the quantity of sulfhydryl groups, as determined by the nitroprusside test, was found to diminish substantially. However, in the absence of casein (rennet whey) and lactose (dialyzed skim milk), such a diminution did not occur. These observations may serve to elucidate the nature of carmelized flavor development in heated milk.

M32 The Utilization of the Mineral-Ion Exchange Principle in Stabilizing Evaporated Milk. D. V. JOSEPHSON AND C. B. REEVES, Department of Dairy Technology, Ohio State University.

The proteins in evaporated milk usually are somewhat unstable to the heat of sterilization. This condition has been attributed primarily to an excess of calcium ions and, possibly, of magnesium ions and is corrected in commercial manufacture by the use of certain salts, usually disodium phosphate.

The present study was undertaken to investigate the possibility of using some ion exchange method to remove the excess calcium and magnesium ions from milk and render the concentrated product stable to 240° F. for 15 minutes. A cation exchanger (Amberlite IR–100) which exhibits a high degree of specificity for polyvalent cations was used for treating whole milks and skim milks. When this resinous type material was used in the sodium cycle, it effected an efficient removal of calcium (60 per cent) and magnesium from milk.

The mineral-ion exchange treated milks were added as fluids, concentrates, and powders to the bulk lots of regular fluid milk before forewarming or to the untreated concentrates before sterilization. Under average conditions where evaporated milk required 2 to 6 ounces of disodium phosphate per 1,000 lb. of concentrate to produce stability, the same correction was effected by treating from 0.5 to 2.0 per cent of the original milk (or equivalent) by the mineral-ion exchange process. The addition of the mineral-ion exchange treated milk at the hot well before forewarming produced greater efficiency of stabilization than addition later.

The mineral-ion exchange treated milk can be used as a fluid, concentrate, or powder with equal effectiveness. Both whole and skimmed milks can be treated by the process, but skim milk is more practical from the commercial point of view. Changes in the calcium, phosphorus, and ash content of evaporated milk as a result of mineral-ion exchange treatment are so insignificant as to be within the limits of error for the analytical techniques used. The mineral-ion exchange process as employed in these experiments with evaporated milk appears to be a practical procedure for the control of heat coagulation of evaporated milk.

M33 The Manufacture of High-Solids Evaporated Milk. MARK KEENEY AND DONALD V. JOSEPHSON, Department of Dairy Technology, Ohio State University.

This study was undertaken to investigate the possibility of manufacturing a commercially-acceptable evaporated milk containing an appreciably greater total solids content than the present standard product of 26 per cent total solids. Attention was focused on the manufacture of evaporated milk at levels of 32, 34, 36, 38, 39, and 40 per cent total solids.

The intensification of the physical and chemical changes in milk caused by the heat of sterilization at high solids concentration has handicapped the development of such a product. Prohibitive amounts of disodium phosphate are necessary during most seasons of the year to stabilize evaporated milk containing 34 to 40 per cent solids. In this study the mineral-ion exchange principle was used and compared with the procedure of stabilization by disodium phosphate.

During January, February, and March the 40 per cent solids evaporated milk could be stabilized against heat coagulation by the addition of 8 to 11 per cent (on a solids basis) of mineral-ion exchange powder (from which 60 per cent of the calcium had been removed) at the hot well. The same milks, untreated, required from 70 to 85 ounces of disodium phosphate per 1,000 lb. of 40 per cent solids milk to prevent coagulation.

As the solids content was increased, the degree of browning was intensified. The products reconstituted to give 13 per cent solids exhibited lower pH as the solids concentration of the sterilized product increased. A normal milk which exhibited a pH of 6.55 before sterilization usually had a pH of about 6.35 after sterilization at a normal concentration. The pH of sterilized high solids concentrates decreased as solids increased, so that a value of 6.20 or lower was common with a 40 per cent solids product (reconstituted).

Sterilization causes a considerable change in the optically active lactose content of evaporated milk. The per cent destruction of optically active lactose ranged from 9 to 15 per cent. The per cent solids at sterilization seemed to have little or no effect upon the per cent destruction.

All of the batches containing 32 per cent or more solids left a noticeable mineral deposit in the cans within a few days after sterilization. This was true in both the mineral-ion exchange treated batches and the products stabilized with disodium phosphate.

M34 Condensing Whole Milk for Ice Cream Mix with the Vacreator.
G. H. WILSTER AND K. C. LU, Oregon State College.

The process of condensing whole milk with a "baby" size Vacreator was studied. The whole milk first was placed in a storage vat and then pumped either through a flash preheater or a tubular preheater, heated to 200 ± 5° F., and evaporated under 24 and 28 inches of partial vacuum, consecutively, in the Vacreator. The partially condensed whole milk was returned to the storage vat as it emerged from the machine. By continuous circulation through the Vacreator, the milk was condensed to the desired ratio of concentration of about 2.1 : 1 for use in ice cream mix.

Increasing the rate of inflow of milk to the Vacreator up to its maximum intake capacity resulted in a higher water-evaporating efficiency. An increase in the rate of inflow of the milk from 85 to 105 lb. per minute increased

the water-removal capacity of the machine from an average of 6.39 to 8.04 lb. per minute (383.4 to 482.4 lb. per hour).

The average bacterial count of the milk in the storage vat dropped from 85,600 per ml. before condensing to 1,500 per ml. after 30 minutes of condensing. The average bacterial count of the condensed milk when leaving the Vacreator at the conclusion of the process was 100 per ml.; the count of the finished condensed product in the storage vat was about 200 per ml.

The Vacreator-condensed whole milk stored at 80° F. was satisfactory for about 12 hours, while at 44° F. the milk kept satisfactorily for about 1 week. When 5 per cent of sucrose was added to the condensed milk and the milk stored in 1 pint cardboard containers at 0 to 10° F., the milk kept satisfactorily for 34 days. The reconstituted milk had a fine flavor and showed no protein destabilization.

One of the problems in condensing milk with a Vacreator for an ice cream plant is the determination of the total solids content of the condensed product. Equations that show the relationship between the total solids (Y), the Baumé reading (X), and the fat content (Z) for the condensed whole milk made from high testing and low testing milk and also for the condensed skim milk were formulated. The equation most valuable when milk of high test was used was $Y_E = 1.5642\,X + 1.5020\,Z - 0.3286$, with a multiple correlation coefficient of 0.9989 and a standard error of estimate of 0.2112. When milk of low test was used, the most valuable equation was $Y_E = 1.9012\,X - 0.0368$, with a correlation coefficient of 0.9999 and a standard error of 0.0151.

M35 A Study of the Use of Nordihydroguaiaretic Acid in the Storage of Frozen Sweet Cream. J. W. Stull, E. O. Herreid, and P. H. Tracy, Illinois Agricultural Experiment Station.

A study has been made of the effectiveness of the antioxidant nordihydroguaiaretic acid (N.D.G.A.) in retarding or preventing the development of the oxidized flavor in unsweetened frozen cream. Four lots of cream were prepared. These consisted of high and low quality cream pasteurized both at 150° F. for 30 minutes and 170° F. for 15 minutes. Each lot was divided into two series, one with the copper and N.D.G.A. added before pasteurization and the other with the copper and antioxidant added after cooling to 45° F. The copper was added from an aqueous solution to make a concentration of 0.5 p.p.m. based on the total weight of the cream. The N.D.G.A. was added from a glycerol solution and a water suspension to make concentrations of 0.00125, 0.0025, and 0.005 per cent of the fat content of the cream. The cream was stored in tinned cans at a temperature varying from – 5° to – 20° F. When taken out of storage, the cream was thawed and judged for flavor. The oxidation-reduction potential (Eh) of the cream was determined at this time. In order to accelerate further the development of the oxidized

flavor, the cream was held at 40° F. for an additional week and then judged again.

In storing the cream for 7 to 9 months at subzero temperatures, it was found that the presence of from 0.00125 to 0.005 per cent N.D.G.A. would retard the development of the oxidized flavor. The glycerol and the water solutions were equally effective. The Eh of the cream increased slightly during storage. However, there was no significant difference in the Eh values of those samples which had the oxidized flavor and of those which did not have this off flavor at the end of comparable storage periods. These results indicate that Eh values for storage cream have no particular significance in measuring the development of the oxidized flavor.

In every case the copper which was added to the cream after it had been cooled to 45° F. induced the oxidized flavor more rapidly than the copper which was added to the cream prior to pasteurization. Pasteurization at 170° F. for 15 minutes protected the cream against the development of the oxidized flavor to a greater extent than pasteurization at 150° F. for 30 minutes.

The intensity of the oxidized flavor increased in the control samples which were held at 40° F. for 1 week whereas this did not occur in the samples which contained N.D.G.A. Control samples not oxidized when they first were taken out of storage often developed oxidized flavor during storage at 40° F.

PRODUCTION SECTION

P1 The Influence of Streptomycin upon the Livability and Bacterial Content of Bull Semen. J. O. Almquist, W. T. S. Thorp, and P. J. Glantz, Pennsylvania Agricultural Experiment Station.

Investigations on the use of penicillin in diluted bovine semen led to subsequent studies with streptomycin. Preliminary studies indicated that levels of 2,500 to 10,000 μg. of streptomycin per ml. of diluted semen markedly reduced the ability of spermatozoa to maintain motility during storage. Thus an experiment was designed in which streptomycin was added to 10 samples of bull semen diluted 1 to 24 with yolk-citrate at the rate of 0, 100, 250, 500, 750, 1,000, 1,250, 1,500, and 2,000 μg. per ml. of diluted semen. The samples were stored at 4.5° C. (40° F.) and the percentages of motile spermatozoa were estimated every 2 days for 20 days. At 0, 8, and 16 days' storage, subsamples were taken for bacterial counts and streptomycin assays.

Analysis of variance involving 900 motility estimations showed no significant differences in spermatozoan livability at levels of 0, 100, 250, 500, 750, and 1,000 μg. However, the three highest levels tested (1,250, 1,500, and 2,000 μg. per ml. of diluted semen) caused a highly significant decline in livability. Based on a highly significant linear regression, the

mean percentage of motile spermatozoa during 20 days' storage decreased by 0.5 per cent for each additional 250 μg. of streptomycin.

Plate counts were made on nine samples of diluted semen stored for 0, 8, and 16 days. Veal infusion agar containing 4 per cent ox blood was used for total bacterial counts, and desoxycholate agar was used for enumeration of bacteria belonging to the coliform group. The blood agar plates were incubated for 48 hours at 37° C., while the desoxycholate agar plates were held for 24 hours at 37° C.

Levels of streptomycin above 100 μg. per ml. of diluted semen inhibited the growth of bacteria. Freshly diluted semen without streptomycin contained an average of 5,000 bacteria per cc., as compared to an average of 120 bacteria per cc. for samples with added streptomycin. After 8 days' storage at 4.5° C., the tubes of untreated semen averaged 82,000 bacteria per cc. while those containing streptomycin averaged 2,000 bacteria per cc. of diluted semen. After 16 days' storage the average bacterial count for diluted semen without the antibiotic was 131 million per cc. and 137,000 per cc. for diluted semen containing streptomycin.

Very few typical coliform bacteria were present on the desoxycholate agar plates. Only one sample had countable colonies and these were present only in the undiluted semen and the tube of freshly diluted semen which received no streptomycin. The number of coliform bacteria increased in these two tubes during the 16-day storage period.

Streptomycin was stable for 16 days in diluted semen stored at 4.5° C., as determined by assays with the standard cylinder plate method using *Bacillus subtilis* as the test organism. Studies are now in progress using streptomycin in combination with penicillin, since it appears that streptomycin might aid in controlling certain penicillin-resistant organisms sometimes found in semen.

P2 Some Effects of Adding Thyroxine to Bull Semen. A. B. SCHULTZE AND H. P. DAVIS, University of Nebraska.

d,l-thyroxine was added in 0.3, 0.7, 1.0, and 4.0 μg. quantities to 10 ml. of diluted bull semen. The effect of these additions of thyroxine on the oxygen consumption of the sperm was determined by a Barcroft-Warburg respirometer.

An average of ten determinations showed that the 0.3 μg. level increased the oxygen consumption 5 per cent above the control. The 0.7 μg. level resulted in an average increase of 9 per cent in oxygen consumption above the controls (24 determinations). Four of the 24 samples were retarded in oxygen consumption by the addition of thyroxine. The 1.0 μg. level increased oxygen consumption 4.6 per cent above the controls (27 determinations). Six of the 27 samples showed retardation of oxygen consumption from the addition of thyroxine. The 4.0 μg. level increased oxygen con-

sumption 4 per cent (13 determinations). Six of the 13 samples were retarded in oxygen consumption by the addition of thyroxine. The addition of 80 μg. to 10 ml. of diluted semen resulted in inhibition of oxygen consumption to 92 per cent of the control level for 4 determinations. The majority of the determinations were made the day following the collection and treatment of the semen. The thyroxine was added 1–2 hours after collection and dilution of the semen.

Seventy semen samples treated with 1 μg. of d,l-thyroxine per 10 ml. diluted semen and used in artificial breeding associations showed a conception rate of 61.4 per cent, based on a 5 months' non-return period (1,623 services). Untreated semen samples from the same bulls during the same period (2,954 services) showed a 56.7 per cent conception rate.

P3 Total Digestible Nutrients and Protein Levels for Dairy Bulls Used in Artificial Insemination. CECIL BRANTON, R. W. BRATTON, AND G. W. SALISBURY, Laboratory of Animal Breeding and Artificial Insemination, Department of Animal Husbandry, Cornell University.

The increasing number and size of bull studs supplying semen for artificial insemination has focused attention on the inadequacy of quantitative information relating the feeding of different levels of total digestible nutrients and total protein to semen production, fertility, and body weight changes of bulls.

From this general situation the problem was reduced to one of relating controlled levels of T.D.N. and protein intake to the changes in measurable characteristics of semen quantity and quality, relative fertility, and changes in body weights.

Using nine Holstein and nine Guernsey bulls, T.D.N. levels of 100, 120, and 140 per cent of Morrison's dry dairy cow maintenance requirements were studied by means of a "double change-over" experiment involving three 90-day periods. The T.D.N. requirements were based on the initial body weights of the bulls. A continuous-type protein experiment involving the feeding of concentrate mixtures containing 12, 16, and 20 per cent total protein was superimposed on the T.D.N. experiment. Forty per cent of the T.D.N. requirement was furnished by the concentrates and the remaining 60 per cent from mixed hay containing approximately 10 per cent of legumes.

Neither the quantity nor the quality of the semen was related to the level of T.D.N. fed the bulls. Significantly higher numbers of spermatozoa per mm.^{3}, lower volume per ejaculate, motility, and fewer total spermatozoa per ejaculate were produced by the bulls fed the concentrate containing 20 per cent total protein as compared to those fed the other mixtures. These differences are not considered at present to be of practical importance.

The fertility of the bulls as judged by 5-months' non-returns to first services from the semen samples used for insemination did not vary significantly with either the T.D.N. or protein level fed.

All levels of T.D.N. fed resulted in significant changes in body weights. On the other hand, protein levels and the interaction of protein and T.D.N. did not result in significant changes in body weight. Based on the linear regression between initial body weight and the estimated daily T.D.N. required to maintain constant body weight, the following practical feeding standard for dairy bulls in active service tentatively is suggested: 1 lb. of hay plus 0.4 to 0.5 lb. concentrate mixture containing about 12 per cent total protein per 100 lb. of body weight.

P4 A Study of Factors Affecting the Length of Gestation in Dairy Cattle.[1] H. A. HERMAN AND R. W. SPALDING, Department of Dairy Husbandry, University of Missouri.

Factors affecting the length of the gestation period of dairy cattle in the Missouri Station herd for the period 1900–1945 were studied. The average length of gestation in 1,957 cases, all twins and abortions excluded, was found to be 279.4 ± 5.59 days. This study included 876 Jerseys, 962 Holsteins, and 119 Guernseys.

The average length of gestation for the Jerseys was 280.36 ± 5.80 days. Four hundred and twenty-nine Jersey males were carried an average of 280.90 ± 5.38 days and 447 Jersey females an average of 279.85 ± 4.25 days. The average length of gestation for the Holsteins was 278.11 ± 4.98 days. Four hundred and ninety-five females were carried an average of 277.51 ± 3.79 days and 467 males an average of 278.75 ± 5.94 days. The average length of gestation for the Guernseys was 284.00 ± 4.96 days. Sixty-five males were carried an average of 284.57 ± 4.97 days, a day longer, on the average, than females.

Twins (29 pairs) and triplets (1 set) comprised 1.5 per cent of the births in the Missouri Station herd. The average length of gestation for multiple births, omitting all abortions, was found to be 271.56 ±8.93 days.

The data indicate a slight increase in the gestation length for mature cows as compared to the gestation period of first- and second-calf heifers. Cows calving during the fall and winter months carried their calves an average of 1 to 3 days longer than those cows which calved during the spring and summer months. Animals positive to the agglutination test in 1:100 dilutions (57 cases) were found to have an incidence of premature births of 35 per cent, and only 65 per cent of the offspring was carried above 265 days. Animals reacting in dilutions of 1:25 and 1:50 were found to carry 91 per cent of their calves more than 265 days. The incidence of

[1] Contribution from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series no. 1051.

premature births in these two groups was 8.47 per cent and 9.09 per cent, respectively. The distribution of abortions in terms of gestation length indicates that 87 per cent of these occur after 5 months of pregnancy. The mean number of days pregnant at which abortions occurred was found to be 193.90 ± 52.19 for Holsteins (51 cases), 209.12 ± 43.15 for Jerseys (81 cases), and 229.25 ± 63.81 for Guernseys (4 cases).

P5 The Relationship of Semen Production, Age, Plasma Calcium, and Plasma Phosphorus to the Plasma Phosphatases of Dairy Bulls. J. T. Reid, G. M. Ward, R. L. Salsbury, and C. E. Shuart, Rutgers University.

Although few investigations have been made of the plasma phosphatases in dairy cattle, numerous accounts are found in which the alkaline plasma phosphatase is related to bone metabolism in other species. A study was made of the relationship of the plasma phosphatases to semen production, plasma calcium and phosphorus, and age of dairy bulls from which semen was being obtained at various rates.

In 144 analyses made of the plasma of 33 bulls, the average alkaline phosphatase content was 8.98 units per 100 ml. (range 1.99–21.03) and the average acid phosphatase was 2.09 units per 100 ml. (range 0.35–6.63).

The level of the alkaline plasma phosphatase varied inversely with the number of spermatozoa produced. The mean phosphatase units found in the plasma of bulls producing within the following ranges of spermatozoa concentration $\times 10^8$ daily were: 0.00, 15.96; 2.00–4.50, 11.84; 4.51–7.00, 11.28; 7.01–9.50, 9.61; 9.51–12.00, 6.99; 12.01–14.50, 6.90; and 14.51–16.00, 4.66.

An average plasma level of 4.93 alkaline phosphatase units per 100 ml. was found for 10 bulls yielding an average of one ejaculate per 2.5–3.5 days. When the same group of bulls was rested for a period of 52 days, the average enzyme concentration was 10.95, or an increase of 2.2 times. One bull from which no semen ever had been obtained showed an average phosphatase concentration of 18.95 units (range 18.04–19.75 in five monthly analyses). After nine samples of very dilute semen totaling 193 ml. had been collected by massage technique during a 16-day period, the enzyme level dropped abruptly to 5.24 units.

The coefficients of correlation between the level of alkaline plasma phosphatase and several factors involved in the rate of semen production were: number of ejaculates per day, −0.71; volume of semen per day, −0.83; and number of spermatozoa per day, −0.86. The daily averages were based on the number of ejaculates and semen produced during a 3-month period prior to plasma analysis.

No relationship existed between the plasma concentration of acid phosphatase and the frequency of semen collection or quantity of semen pro-

duced. Also, no relationship was found between the concentration of the enzyme in the plasma and the plasma levels of calcium and inorganic phosphorus, age of bulls, or ration fed.

These data would indicate that the quantity of semen, more particularly the number of spermatozoa, produced by dairy bulls is the major factor determining the concentration of alkaline phosphatase in the blood plasma.

P6 Light Variation Associated with Conception Rate in Artificial Breeding. ERNEST MERCIER, Ministry of Agriculture, Quebec, Canada, AND G. W. SALISBURY, Department of Animal Husbandry, Cornell University.

Many studies conducted on the breeding records of cattle have shown that reproductive efficiency may be associated with climatic factors. Since seasonal fluctuations in fertility level of cattle occur at high latitudes where the summer temperature does not reach the point of hyperthermal rise, the authors have been interested in determining what other climatic factors were involved.

A study of the breeding records of three herds of cattle located 2° of latitude apart in eastern Canada revealed that the conception rate of these herds was significantly lower during winter and spring than during summer and fall.

The results of four similar studies, involving 150,000 breeding records of groups of cows and bulls of various ages bred artificially in New York State, paralleled those obtained in eastern Canada. In every study, winter was found to be the poorest breeding season of the year. Furthermore, the results showed that the fertility level of cattle of extreme age, either young or old, fluctuated more from season to season than that of mature cattle or cattle of intermediate age. In every case the differences between seasons within age-groups, as well as seasons for all age groups, were statistically significant at either the 5 or the 1 per cent level of probability.

In both locations the over-all fertility level of cattle was found to be highly correlated with the length of daylight, with a lag of 1 to 2 months before the maximum effects of day-length variations were reached. The results of a partial correlation study indicated that variations in outside temperature were of no detectable importance on conception rate of cattle in eastern Canada.

Seasonal variations in length of daylight are believed to influence markedly the fertility of cattle at high latitude.

P7 Studies of Oxidative Mechanisms in Bull Semen. J. T. REID, R. L. SALSBURY, G. M. WARD, AND G. I. LEONARDI, Rutgers University.

Numerous investigations have evaluated the ascorbic acid concentration

of the semen of various species by virtue of this reductant's ability to reduce 2, 6-dichlorophenolindophenol under controlled conditions of pH and reaction rate. Some of these studies have indicated a relationship of dye-reduction by semen to the fertility state of bulls.

The first portion of this study involved an investigation of the relationship between various bull semen characteristics which are used in quality ratings and the capacity of semen to reduce potassium iodate and 2, 6-dichlorophenolindophenol. A volumetric method using potassium iodate and the commonly employed photelometric dye-reduction method were used in the analysis of more than 400 semen samples.

No great degree of relationship existed between the reducing capacity of semen and the various semen characteristics; however, the concentration of spermatozoa showed the highest degree of relationship to the reducing property.

A high degree of correlation (0.906 ± 0.008) existed between the amount of reduction measured by the potassium iodate and the dye-reduction methods and appeared to be the result of measuring the same reductant(s) by both procedures. This observation initiated the second portion of the study, which dealt with an attempt to designate the amount of reduction attributable to several substances (ascorbic acid and glutathione) known to be present in animal tissues. Although this study is not yet completed, it was found by various treatments that sulfhydryl substances may constitute from 7 to 81 per cent of the reduction in semen generally attributed to ascorbic acid as determined by the reduction of dichlorophenolindophenol dye. The dye-reduction method under the conditions commonly employed to measure ascorbic acid was capable also of determining glutathione in pure solution and of measuring glutathione added to semen.

P8 Collecting Genetic Data through Cooperating Dairymen. N. P. RALSTON, S. W. MEAD, AND W. M. REGAN, University of California.

A dairy cattle breeding experiment at the University of California has been in progress for 29 years. It is designed to study, through inbreeding, the inheritance of milk and fat production and related factors.

A loan bull project was initiated in 1926. Its purpose was to increase the number of females available for the proving of young inbred sons of University herd sires, in order to study more fully the genetic constitution of the University experimental herd and to aid in perpetuating the inbred lines. At present there are nine cooperating dairymen and a number of test herds which have been in the project for 15 or more years.

The cooperators, who are selected carefully, agree to: (a) maintain membership in a cow testing association; (b) practice an approved disease control program; (c) keep accurate records of breedings and calvings, sex of

offspring, and other pertinent information relative to the experiment; and (d) retain and test, during their first lactation, all daughters of the loan bulls.

The close association between the University investigators and the dairymen has aided materially in the management of the herds in order to provide useful experimental data. Members of the University staff make semi-annual visits to each herd and transfer all data to complete herd books and other necessary forms to effectively direct the study. Bulls are loaned according to a planned program to yield the desired information.

The cooperating herds provide approximately 500 females per year. Of the 50 bulls loaned, 39 have been proved, supplying over 1,300 first-calf daughter and dam records. In addition, these herds have supplemented the data collected in the University herd on the inheritance of seven recessive defects, the effect of inbreeding on calf mortality, and other data in the process of being assembled.

P9 Variations in Type Ratings of Individual Ayrshire Cows. GEORGE HYATT, JR. AND W. J. TYLER, West Virginia University.

Type classification programs have been adopted by all the major dairy cattle breed associations. It seemed that the variation in the type of dairy cows throughout a year and from year to year needed to be known before a definite appraisal of type classification programs could be made. Therefore, a study of the variations in type ratings of individual cows classified several times a year was undertaken in 1942 in the Ayrshire herd (known as the Reymann Memorial Herd) at the West Virginia Agricultural Experiment Station. This herd represents approximately 25 years of a continuous, carefully controlled breeding project. All the females that had calved were rated for type approximately three times per year from May, 1942, to December, 1946, by an official inspector appointed by the Ayrshire Breeders' Association. The standard grades of Excellent, Very Good, Good Plus, and Fair were used.

Eighty animals were rated officially three times or more from May, 1942, to December, 1946. Seven animals were rated the same each time they were classified, 47 had a range of one grade, 23 a range of two grades, and three varied three grades.

The repeatabilities between ratings given a cow by the same inspector and between ratings given by different inspectors were computed after the data were analyzed by the analysis of variance. The average correlation coefficient between the ratings of each cow classified by inspector A in May, 1942, October, 1942, and May, 1943, was 0.74. For inspector B, whose ratings were made in October, 1943, and January, 1944, the correlation coefficient was 0.82; and for inspector C, who made his inspections in July, 1944,

and May, 1946, it was 0.62. The repeatability of the ratings of 101 cows classified two or more times by different inspectors was 0.55.

The effect of age on variation of type ratings was studied using 65 females that were classified numerous times at 3 and 4 years of age, 30 classified several times at 4 and 5 years of age, and 27 rated several times at 3, 4, and 5 years of age. There is a small upward statistically significant change in type ratings as the animal matures.

The stage of lactation as a source of variation of type ratings was studied by analyzing the ratings of 63 animals classified 137 times between freshening and the fourth month of lactation, inclusive, 140 times between the fifth and the ninth month of lactation, inclusive, and 173 times between the tenth month of lactation and the next freshening period. The differences are small but do suggest that a little higher rating is obtained when animals are classified shortly before or after freshening rather than in the middle part of their lactation.

Most of the wide variations in type ratings of individual cows apparently can be attributed to the inability of the inspectors to appraise equally certain faults of a cow, especially defects in udder, feet, and legs. For example, 22 of the 26 cows that had a range of two or more grades changed at least two official grades in two consecutive classifications (an interval of 3 to 6 months). For 19 of these animals the main faults recorded were crooked legs, bad feet, or udders defective in either shape or attachment.

These results indicate that uniform cuts for the important defects in feet, legs, and udder should be adopted and adhered to as closely as possible by the various inspectors. An average of several type ratings of an individual cow seems a more accurate guide to her true type conformation than one official rating.

P10 The Heritability of Official Type Ratings and the Correlation between Type Ratings and Butterfat Production of Ayrshire Cows.
W. J. Tyler and George Hyatt, Jr., West Virginia University.

The objectives of this study in dairy cattle breeding were to estimate the portion of the differences in official type ratings that is transmitted from parents to offspring and to compute the correlation between type rating and butterfat production of cows (records adjusted to a 305-day, mature equivalent, twice-a-day basis).

The classification ratings of 3,738 paternal half sisters and of 1,601 cows out of classified dams were used to estimate the heritability of single type ratings. From these data this figure was estimated to be 0.3, with 95 per cent fiducial limits of 0.19 and 0.41. These results suggest that selection for type through a type classification program should improve the type of future generations of dairy cattle.

The relationship within herds between classification rating and production of butterfat was computed from data on 5,177 cows. There was an average increase of 13 lb. of butterfat for each increase of one type grade. The correlation coefficient was 0.16 between the type rating and first butterfat record, 0.16 between type rating and the butterfat record begun nearest the date of classification, and 0.19 between type rating and the average of all the butterfat records of the cow. These coefficients were statistically significant, but their size indicates limited practical significance. This would indicate that selection within herds for better type only would not result in any substantial increase in butterfat production. Likewise, selection for increased production of butterfat alone would not improve the type of the animals to any great extent.

P11 Analysis of the Production Records of Crossbred Dairy Cattle.
R. A. HILDER AND M. H. FOHRMAN, Bureau of Dairy Industry, U. S. Department of Agriculture.

A popular notion about crossbreeding is that the offspring resulting from interbreed crosses might show wide variation in butterfat production. This analysis is undertaken to show whether this variation exists in the crossbred herd at Beltsville.

Tables are presented showing the average butterfat production, the standard error of the mean, and the coefficient of variability of several registered and crossbred groups concerned with the experiment. All figures are based on actual first lactation butterfat records.

Four groups of registered Holsteins and Jerseys not connected with the crossbreeding project are used to establish a normal variation for butterfat production. The coefficients of variability for these ranged from 12.75 to 16.28 per cent. Five groups of registered foundation cows for the crossbreeding experiment showed coefficients from 10.25 to 21.36 per cent. The coefficients of variability of the registered daughters and their dams of the three principal sires used in the crossbreeding ranged from 11.82 to 22.59 per cent.

The first 42 two-breed crossbreds to complete first lactation records averaged 589.5 lb. of butterfat, with a coefficient of variability of 9.71 per cent. The first 16 three-breed crossbreds averaged 630 lb. of butterfat with a coefficient of 7.92 per cent. These figures seem to indicate that the crossbred groups exhibit unusual uniformity in butterfat production.

P12 Progress Report on Cross-breeding of Dairy Cattle at Beltsville.
M. H. FOHRMAN, Bureau of Dairy Industry, U. S. Department of Agriculture.

P13 A Case of Intersex in Dairy Cattle.[1] W. W. YAPP, University of Illinois.

The purebred Brown Swiss bull calf which was the subject of this study appeared normal and was sold as a breeding animal, to be delivered in 90 days. Just prior to shipment, the animal was examined carefully by the University herdsman, who thought he detected a slight enlargement of the scrotum. A veterinary confirmed this observation. Assuming the condition to be due to a slight injury, shipment was delayed 2 weeks and treatment to reduce the part begun.

After the condition failed to respond to treatment, it was concluded that a slight hernia was involved and plans were made to reduce the condition by surgery. The first incision of the operation revealed that the individual could not be a normal male. The animal was sacrificed to study the condition.

Inspection revealed a normal male reproductive system except that the testicles and accompanying ducts were absent. A normal female reproductive system, except for a portion of the vagina and vulva, also was found. The size of the bi-cornus uterus was essentially that expected in a normal female of a similar age and weight. The identity of the organ was indicated by the presence of numerous cotyledons.

Histological examination of the various tissues confirmed their identity except that the organ assumed to be an enlarged ovary actually was a vestigial testicle. The presence of this testicular tissue and its ability to secrete testicular hormones accounted for the secondary sexual characteristics of the animal and explains why he was assumed to be a normal male.

An attempt was made immediately to locate other cases similar to this one and also to locate males that had been sold as breeders but had failed to produce progeny. No other cases of intersex similar to the animal described have been found. Two males that were not capable of reproduction were located. Post mortem examination indicated the possibility of intersex but did not show the same development of reproductive organs of both sexes as found in the animal described.

One Brown Swiss bull that had produced several (three definitely known) sterile male progeny, two from the same cow, was located and purchase arranged for. All sterile animals had been sold for beef and could not be examined posthumously. Casual examination by breeders indicated some probability that they may have been cases of intersex. The owner of the bull, fearing that a further test of the breeding qualities of his bull might reflect on his herd, disregarded his promise and sold the animal for beef, thus making it impossible to test further the nature of the sterility found in the progeny that might have resulted from his service.

[1] Members of the Department of Animal Pathology, University of Illinois, especially Dr. L. E. Boley, were very helpful in making post mortems and in identifying tissues.

P14 Dairy Cattle Improvement Work of the Indian Agricultural Research Institute—India.[1] J. D. S. KUMARAN, Department of Dairy Husbandry, University of Missouri.

The Government of India Agricultural Research Institute maintains the Sahiwal herd at New Delhi and the Tharparkar herd at Karnal. The paper deals with the work done at Karnal since 1923. The original home of the Tharparkar cattle is the semi-desert regions of the province of Sind.

The average yield per cow per day was 5 lb. in 1923. Line-breeding, selection, feeding, and sound herd management have resulted in a consistent rise in the milk yield. In 1930 the yield was 8.7; in 1935, 13.4, and in 1945, 20.5 lb. per cow per day.

The calves all are weaned at birth and are fed with standardized milk; the bull calves are fed for 6 months and the heifer calves for 8 months from birth. The average birthweight of the male calves is 54 lb. and the female calves 48 lb. The birth weights of the males increase in a very steady manner as the weight of the dams increase. In the case of the female calves, the increase varies, though the maximum weight is found in the maximum weight class of the dam. The data further show that as the weight of the dam increases, the weight of the calves at birth also increases.

An analysis of 1,202 gestations reveals an average gestation period of 288.4 days, with the male calves taking a longer period than the females.

Heifers are bred after they attain a body weight of 600 lb. The average age of such heifers at first estrus was 23 months and 13 days, with a body weight of 609 lb. The average at first estrus after calving was 34 months, with a body weight of 733 lb. Tables give the different interestral periods for the different age classes.

Some cows have yielded more than 10,000 lb. in 306 days, and Tiqabdi 336 in 1946 yielded 10,369 lbs., which is the highest for the Tharparkar breed.

Pregnant heifers and cows from a fortnight to a month before calving are massaged and milked prenatally, which seems to have a beneficial effect in avoiding milk-fever and mastitis.

The Tharparkar cattle resist high diurnal temperatures and extreme variations in temperature. They have long loose dewfolds with sweat glands. During the hot summer days the temperature at Karnal reaches a maximum of 118° F., and the animals do not suffer any adverse effects from such high temperatures.

P15 The Use of the Pen Barn as a Means of Mastitis Control. P. L. KELLY, D. F. BREAZEALE, G. S. HARSHFIELD, AND A. B. HOERLEIN, South Dakota State College.

[1] Contribution from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series no. 1052.

From November 28, 1945, to April 1, 1946, dairy cows of comparable quality were divided into two groups. Twenty-seven remained in a regular stanchion barn and 13 were placed in a loafing shed. On the basis of strip cup tests, 11 cows in the stanchions and 4 cows in the pens had attacks of mastitis. These data indicate a gain in the control of a mastitis infection by the use of a pen barn, in spite of the fact that stanchions which were exposed to possible drafts were not used.

From November 28, 1946, to April 1, 1947, all cows were kept in stanchions. On the basis of the strip cup test, only 6 cows of the average of 43.4 actually in milk had attacks due to causes other than injury. All of these cows had had previous infection with *Streptococcus agalactiae*. This was true even though all of the stanchions were used.

Apparently during periods of heavy infection with the usual organisms which cause mastitis, the use of a loafing shed where cattle can move at will and lie on a warm floor is an important means of getting the infection under control. However, after the amount of infection has subsided, the use of a pen barn for mastitis control is not so important.

P16 Report on Attempts to Prevent Midsummer Slump in Milk Production by Hay Feeding. D. M. SEATH AND G. D. MILLER, Louisiana State University.

A double-reversal experiment was conducted in 1946 with 20 cows over a period of 60 days to determine the advisability of feeding hay during warm summer months while cows are on pasture. This trial was conducted as a direct result of a previous experiment which showed that cows on hot days often spend less than 2 hours grazing between morning and evening milkings. In the present trial at around 11 a.m. daily, cows were fed mixed white Dutch clover and canary grass hay in racks located in the shade. Two levels of hay feeding were tested. In one case the cows were limited to 0.5 per cent of body weight daily and in the other they were fed all they would clean up. Hay consumption averaged 4.69 lb. per cow daily under the first plan and 5.54 lb. daily for the second.

Milk production records showed that the full hay-feeding plan produced significantly more milk than when no hay was fed. The increases averaged 0.1 and 1.0 lb. milk per day per cow, respectively, for the two test groups. This increase would not be economically profitable. On limited hay the average increase was slightly less (0.4 and 0.1 lb. more per cow daily), again making the practice unprofitable under the conditions prevailing, which included excellent permanent pastures stimulated by abundant rainfall. Weather conditions were considered much better than average for pasture growth and may have influenced the results of the experiment.

P17 The Influence of Cracked Soybeans and Soybean Hay on the Flavor and Quality of Milk. ERLE E. BARTLEY AND C. Y. CANNON, Iowa State College.

The Iowa dairy industry long has been troubled with the development of oxidized and other undesirable flavors in milk. Since soybeans are the chief source of homegrown protein in Iowa, some of these flavors were attributed to the feeding of soybeans on the assumption that soybeans increase the proportion of unsaturated fatty acids in butterfat and thereby would increase the susceptibility of milk to the development of oxidized flavor.

Tests were made to determine the flavor effect on milk when cows were fed four different rations, two containing soybean hay and two alfalfa hay. The two grain mixtures fed were similar, except that one contained cracked soybeans and the other linseed meal. The rations were assigned to the cows within each group and between groups at random according to a latin square design so that each cow was fed each of the four rations in succeeding periods of 5 weeks each. The milk was collected in glass, well-tinned, and rusted tinned containers.

Neither soybeans nor soybean hay as such seemed to affect adversely the flavor of milk; in fact, the milk scores were slightly higher when soybean hay was fed than when alfalfa hay was in the ration. This difference probably was due to a difference in quality of hay rather than to the variety. Contrary to results in a previous trial, the rusted tinned containers adversely affected the flavor of the milk regardless of whether the milk was produced from animals fed soybeans or not. This result was not unexpected, for the exposed iron in the rusted tinned containers easily could act as a catalyst accelerating the oxidation of the fat.

P18 The Value of Adding Ground Alfalfa Hay to the Concentrate Mixture Fed with Prairie Hay in Rations for Dairy Cows. A. H. KUHLMAN AND H. W. CAVE, Oklahoma A. & M. College.

Economical and maximum milk production is possible only when balanced rations are fed. Because of critical shortages of high protein concentrates in recent years, many farmers who use prairie hay or any other non-legume roughage often have been unable to secure sufficient quantities of cottonseed meal or similar feeds to prepare suitable home-mixed dairy concentrates.

Two feeding trials have been completed in which ground alfalfa hay was used to replace part of the cottonseed meal and other feeds in a concentrate mixture suitable for use with prairie hay. In each trial two lots of six cows each were fed the control and experimental mixtures in three 30-day periods according to the double reversal plan commonly used in feeding

experiments with dairy cows. One cow was removed from the experiment during the second trial because of a very sudden decline in milk production. Results, therefore, are based on the records of 23 cows.

Prairie hay was fed to each cow at a level such that the hay supplied an amount of total digestible nutrients equivalent to her requirements for body maintenance. The control concentrate mixture contained 350 lb. ground no. 2 yellow corn, 200 lb. ground oats, 200 lb. wheat bran, and 250 lb. cottonseed meal. The experimental mixture consisted of 245 lb. ground no. 2 yellow corn, 140 lb. ground oats, 140 lb. wheat bran, 175 lb. cottonseed meal, and 300 lb. ground alfalfa hay. On the basis of Morrison's values for the average composition of feeds, the control mixture contained 15.5 per cent digestible protein and 75 per cent T.D.N., while the experimental mixture contained 14.0 per cent digestible protein and 68 per cent T.D.N.

The two rations were equally efficient in maintaining body weights and milk production. All cows were weighed daily during the experiment. The average daily weight of the 23 cows was 1,085 lb. while fed the control ration and 1,102 lb. when fed the experimental ration containing the ground alfalfa hay. The average daily yield of 4 per cent fat-corrected milk per cow in the two trials was 29.67 lb. on the control ration and 29.50 lb. on the experimental ration.

For each 100 lb. of 4 per cent F.C.M. produced, the cows consumed 50.76 lb. of concentrates and 59.66 lb. of prairie hay when fed the control ration and 56 lb. of concentrates and 60.37 lb. of prairie hay on the experimental ration.

Ground alfalfa hay as fed in this experiment replaced 30 per cent of the concentrates in the control ration and effected a saving of 22.8 per cent of the cottonseed meal required. Each 100 lb. of alfalfa hay fed in the experimental ration replaced 24 lb. corn, 13.8 lb. oats, 13.8 lb. wheat bran, and 17.2 lb. cottonseed meal. At current feed prices ground alfalfa hay can be used advantageously in a prairie hay ration for dairy cows.

P19 The Partition of Lipids by the Lactating Dairy Cow as Influenced by Certain Mineral Supplementation. G. M. WARD AND J. T. REID, Rutgers University.

The effects of calcium and other mineral supplements upon the metabolism of lipids were investigated during the first 5 months of lactation of eight Holstein and four Guernsey cows. The study was initiated after the observation was made that cows receiving supplemental calcium excreted a much smaller proportion of the crude fat (ether extract) intake by way of the feces than did their controls not receiving supplemental calcium.

An oxidative method was devised for the estimation of various lipid fractions in feeds and feces, employing chloroform as the solvent, doucil (an artificial zeolite) as the phospholipid adsorbent, and dichromate as the

lipid oxidant. The procedure gave satisfactorily reproducible results and an efficient recovery of various classes of lipids.

All animals excreted similar proportions of the total lipid intake regardless of the mineral supplement(s) received. Although increased intakes of calcium tended to spare the fraction consisting of neutral fat, sterols and waxes and the fraction containing chiefly phospholipids, there was a corresponding increase in the excretion of the fraction comprised of soaps and free fatty acids, indicating that mineral supplementation was without effect upon the total lipid economy of milking cows but was qualitative rather than quantitative in effect. The observed differences relative to the smaller proportion of ingested ether extractives lost in the feces of animals receiving supplemental calcium were attributed to an increased formation of soaps, which were not measured in the feces of these animals because of the insolubility of soap in ether.

These results indicated that the estimation of crude fat by the commonly employed ether extraction procedure is apt to be misleading in experiments involving the analyses of dairy cow feces.

During the relatively short period of experimentation no apparent relationship existed between the efficiency of lipid use and the stage of lactation.

P20 Cobalt Tolerance in Young Dairy Cattle. H. A. KEENER, G. P. PERCIVAL, AND K. S. MORROW, University of New Hampshire, AND G. H. ELLIS, U. S. Plant, Soil and Nutrition Laboratory, Ithaca, New York.

Cobaltous sulfate was fed to young Holstein cattle at levels varying from 5 to 125 mg. of cobalt per 100 lb. of body weight per day. Certain levels of cobalt feeding were maintained for periods up to 34 weeks, although some animals actually received cobalt continuously for periods up to one year. One 2-year-old Holstein heifer was fed the equivalent of over 230 mg. of cobalt per 100 lb. of body weight per day for 28 days.

The first effects of excessive cobalt consumption observed were increased hemoglobin, red blood count, and packed red cell volume. These effects usually were observed only after a considerable period on the higher levels of cobalt intake. On the highest levels a few animals went off feed, consumed less water, and exhibited a rough hair coat and an unsteady gait.

It would appear that growing dairy cattle may consume about 50 mg. of cobalt per 100 lb. body weight per day without ill effects. This value is well over one hundred times the amount normally consumed from commercial cobalt-supplemented dairy rations.

P21 Phosphorus Metabolism Studies. I. Secretion and Partition of Dietary Radioactive Phosphorus in the Milk of the Dairy Cow.

C. L. Comar, R. B. Becker, P. T. Dix Arnold, W. A. Krienke, and George K. Davis, Florida Agricultural Experiment Station.

Separated phosphorus 32 from the United States Atomic Energy Commission is being used in studies of phosphorus metabolism and particularly phosphorus secretion in milk. Radioactive phosphorus was administered quantitatively in feed as disodium phosphate solution. Measurements were made with a dipping type Geiger-Mueller tube directly on the milk when there was sufficient activity, or on an ash solution when concentration was necessary.

The phosphorus was given in the afternoon feeding as a single dose to each Jersey cow selected from the Station herd. Milk samples were taken the following morning and at subsequent regular milkings twice daily. The highest concentrations of radioactive phosphorus always were found in the first three milkings, decreasing regularly thereafter. Activity has been observed in the milk 17 days after administration of the single dose. Present data, considered as preliminary, may be summarized as follows: With three animals near the peak of lactation (31 to 44 days), and producing 33 to 22 lb. of milk daily, 15.1 to 12.2 per cent of each phosphorus dose was secreted in the milk during the following 10 days. Three other cows in mid-lactation (129 to 196 days), producing 20.8 to 16.2 lb. of milk daily, secreted 8.1 to 7.3 per cent of the dosage in the milk during 10 days.

Fractions of the milk in which none of the radioactive phosphorus was found were the butterfat, the ether extracts of the buttermilk, and the lactalbumin. The casein fraction, whether prepared by acid precipitation followed by washing or purified according to the Hammarsten procedure, contained an average of 25 per cent of the radioactive phosphorus present in the skim milk from which it was obtained. The sum of the casein and acid serum values agreed with the activity as measured in the original skim milk.

P22 Feeding Value and Digestibility of Dehydrated Sweet Potatoes.

L. L. Rusoff, D. M. Seath, and G. D. Miller, Louisiana State University.

Within the past few years dehydrated sweet potatoes have been used more and more in the southern states as a carbohydrate feed for livestock. The nutritive value of dehydrated sweet potatoes for dairy cows has been investigated at the Louisiana Station. Three feeding trials and four digestion trials were run on dehydrated sweet potatoes representing products produced in 1944, 1945, 1946, and 1947. The percentage composition on the dry basis of the 1947 dehydrated sweet potatoes, which is a typical analysis, showed 85.35 per cent dry matter, 4.17 per cent crude protein, 1.15 per cent crude fat, 4.46 per cent crude fiber, and 84.44 per cent N.F.E.

In feeding trials with dairy cows, dehydrated sweet potato meal was found to be equal to approximately 88 per cent of yellow corn. Milk production and butterfat yields favored yellow corn meal by 4.05 and 4.55 per cent, respectively. Daily milk production for cows on the dehydrated sweet potatoes was 24.9 lb. compared with 25 lb. for cows fed ground snapped corn, with allowance made for cob and shuck. Dehydrated sweet potatoes made from whole tubers were palatable, while a product made from culled, bruised, sectioned potatoes and peelings was slightly unpalatable.

Digestion trials showed that dehydrated sweet potatoes contained from 71 to 81 per cent T.D.N. The N.F.E. was highly digestible, while the other constituents showed an apparent lack of digestibility. Since the N.F.E. made up over 84 per cent of the dry matter of the dehydrated sweet potatoes, the other constituents would have but a small effect on the T.D.N.

Dehydrated sweet potato meal is of value in the dairy ration not only because of its high digestibility of carbohydrate but also because of its high carotene content.

P23 Studies on the Globulins of Bovine Colostrum. I. Isolation and Properties of a Water Soluble Globulin.[1] R. G. HANSEN AND P. H. PHILLIPS, Department of Biochemistry, University of Wisconsin.

Globulin protein has been isolated from colostrum by precipitation with alcohol in the cold, under carefully controlled conditions of alcohol concentration, pH, protein concentration, salt concentration, and temperature. This material probably contains the euglobulin and pseudoglobulin of Howe. A water soluble globulin also has been isolated from colostrum by ammonium sulfate fractionation according to the method of E. L. Smith. This material was found to be homogenous in the ultra centrifuge and about 95 per cent homogenous when subjected to electrophoresis.

Amino acid determinations have been made on this protein by microbiological assay. The analyses indicate a striking similarity in amino acid composition to purified human serum gamma globulin. A difference from the casein and the β-lactoglobulin of normal milk was indicated. In agreement with the findings of Smith, the most highly purified globulin contains carbohydrate material. The purified globulin has been fed to new-born calves and was found to increase the gamma globulin fraction of the blood serum. Electrophoretic studies indicate a similarity between these two proteins. Attempts to stimulate development of the serum gamma globulin fraction of the deficient calf, by seeding with an intravenous injection of the colostrum globulin at a level of approximately one twenty-fifth of the normal amount of gamma globulin present, were unsuccessful.

[1] We wish to express our appreciation to Prof. J. W. Williams for his cooperation and to Messrs. L. A. Henderson and R. L. Potter for amino acid analyses.

P24 Studies on the Globulins of Bovine Colostrum. II. The Absorption of Globulins by the Young Calf.[1] R. G. Hansen and P. H. Phillips, Department of Biochemistry, University of Wisconsin.

Electrophoretic measurements on the serum of calves fed colostrum and on the serum of colostrum-free calves have been extended. In agreement with existing data, there is a marked increase in the slow-moving globulins (gamma globulins) of the young calf upon the ingestion of colostrum. If the new-born calf is given only normal milk, followed after 36 hours by colostrum, no increase in these serum protein fractions is noted.

An enzyme preparation from the gastric mucosa and chyme of a normal calf fed with colostrum was partially successful in preventing the increase of globulins of the blood serum in new-born calves.

If calves were raised on a ration free of colostrum, the blood serum remained low in its content of the gamma globulins until the calf was about 8 weeks of age, at which time the gamma globulin concentration approached a normal value.

Colostrum placed directly by operative technique into the small intestine of a gamma-globulin deficient calf at 2 weeks of age resulted in no measurable increase in the blood serum globulins.

These results suggest that a probable combination of increased digestive activity and variation in the permeability of the gut is responsible for the above observations.

P25 Tocopherol Levels in the Colostrum and in the Early Milk of the Dairy Cow. D. B. Parrish, G. H. Wise, and J. S. Hughes, Kansas Agricultural Experiment Station.

The tocopherol content of colostrum and of early milk from dairy cows of four different breeds was determined for the first four and the eighth days postpartum. Wide individual differences were observed. In all cases in which cows had the usual dry-rest period, with or without dietary tocopherol supplement, the average rate of decrease during the colostric period followed roughly an exponential curve with approximately the same slope for all individuals. Supplements of 500–1,000 mg. of tocopherol starting one month prepartal increased the tocopherol content of first colostrum 30 to 50 per cent above that in the colostrum of cows receiving no supplement; 10 g. of tocopherol per day increased the tocopherol in colostrum four to five times above the level for unsupplemented cows.

During the first four days, a 100-lb. calf fed at the rate of 10 lb. of colostrum daily would receive from its dam on an unsupplemented ration 28 to 86 mg. of tocopherols; from dams supplemented with 500 to 1,000 mg.

[1] We wish to express our appreciation to Professor J. W. Williams for his cooperation and to Dr. C. K. Whitehair for performing the operation.

of tocopherol daily, 61 to 185 mg.; and from dams supplemented with 10 g. tocopherol daily, 205 to 373 mg. Ingestion of colostrum caused a rapid increase in the tocopherol level in the blood serum of the new born calf, being most marked when prepartal intake of tocopherols by the dam was high. The nutritional significance of tocopherols in the diet of the calf has not been established.

P26 Action of Bacterial Filtrates Infused into the Mammary Gland.
MAX L. DAWDY AND W. E. PETERSEN, University of Minnesota.

Bacterial-whey filtrates have been infused via the teat canal into the mammary gland in an attempt to find the causative mechanism in bovine mastitis. The pathogenic organisms, two *Staphylococcus* species, three species of the coliform group, and one culture of *S. agalactiae* in pure culture have been obtained from various acute and chronic mastitic quarters. Fresh whey from casein precipitation with rennet, the only medium found non-irritating to the tissue, rendered sterile by means of the Seitz filter, was inoculated with the desired culture and incubated 24, 48, and 72 hours at 37° C. The sterile filtrate was obtained by the Seitz filter and infused into the mammary gland in quantities of 2.5, 5, and 10 ml.

The filtrate from the coliform groups, when infused, results in all the manifestations of acute mastitis, with equal degree, regardless of volume infused or incubation time. A direct correlation with incubation time results with the staphylococcus, and no reaction results in the case of the filtrates of *S. agalactiae.*

Intramammary infusion of the filtrates into a large number of normal quarters consistently has produced the following manifestations: (a) Hardness and swelling of the quarter in 1 to 2 hours. (b) Clots in the milk in 2 to 4 hours, with the infused quarter up to twice its normal size. (c) Shivering, humped back, and pilo-erection for 2 to 4 hours, followed by body temperature increases of 4 to 6° F., usually reaching a peak in 6 to 8 hours. Acute inflammation of the quarter also occurs. (d) Rapid fall of body temperature to about normal at 12 hours. (e) Drop in milk production. (f) Decrease in swelling and inflammation at about 24 hours, but palpable thickness of the infused quarters with physically abnormal milk persisting about 4 days.

Although the effective product of the filtrate yet is undetermined, its action has similarity to bacterial toxin reactions. In mice of 8 weeks of age, an M.L.D. of 0.6 ml. of the coliform filtrate was determined, but a lethal dose of the staphylococcus filtrate has not been reached. Red blood cells are hemolyzed almost completely. The clots obtained have a physical resemblance to blood fibrin clots. The milk drawn 1 to 2 hours following infusion can be shown to react to the anti-coagulation mechanism of blood

by citrate and subsequent coagulation with calcium chloride, suggesting that the clots found in mastitis may be the result of change in vascular permeability to blood proteins.

P27 The Effect of Intramammary Treatment for Mastitis upon Milk Production.[1] ERIC W. SWANSON AND H. A. HERMAN, Department of Dairy Husbandry, University of Missouri.

A major consideration in the intramammary treatment of lactating cows infected with streptococci but not showing clinical mastitis is the effect such treatment will have upon milk production. Since the use of sulfanilamide in oil and penicillin in water seemed to cause the least reaction of any mastitis-treatment materials injected into the udder, the effect of these upon milk production has been studied in the University of Misouri herd. The average daily milk production was computed for 3 days prior to treatment, during treatment, and for 7 days after treatment, with critical comparisons being made between the pretreatment average and the average production during treatment. Sixty-three series of treatments with sulfanilamide in iodized mineral oil, injected once daily for 4 days, were studied; 19 series of treatments with penicillin in distilled water, injected twice daily for 2 days, were included.

Treatment with penicillin did not cause a significant change in milk production. The average change was a decrease of 1.56 lb. per day, but 10 of the 19 cows increased in production during treatment. The sulfanilamide treatments were analyzed according to the number of quarters treated, amount of milk produced, and size of injection. In all groups a significant decrease in milk production occurred, and the pretreatment level was not attained until about 7 days following cessation of treatment. The average decreases in daily production when one, two, three, or four quarters were treated were, respectively, 2.59, 3.07, 3.43, and 3.23 lb. Differences due to number of quarters treated were not significant. This would indicate that the cause of the decline may not be a simple mechanical or chemical effect upon the milk secreting tissue but may be due to greater effects, possibly of a systematic nature which affects milk secretion of the entire udder when one or more quarters are infected. Decreases did not vary directly with production, averaging 1.71 lb. for 1- to 20-lb. producers, 3.71 lb. for 21- to 40-lb. producers, and 2.40 lb. for producers above 40 lb. The high-producing cows seemed to reach their pretreatment level faster than low-producing cows following cessation of treatment. Differences between decreases from 50, 60, and 80 ml. injections were not significant, although five of six cows given 80 ml. injections declined more than when 60 ml. were injected.

[1] Contribution from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series no. 1047.

P28 The Use of Penicillin in the Treatment of Mastitis vs. Natural Recovery. D. F. BREAZEALE, P. L. KELLY, G. S. HARSHFIELD, AND A. B. HOERLEIN, South Dakota State College.

These experiments have been in progress since May, 1945. Previous to this time various other medications had been used in this herd. Approximately one-half of the cows had mastitis when the penicillin treatments were begun. Since penicillin could be obtained only in very limited quantities, 10 cows showing the most extensive indurations, and therefore thought to be least likely to yield to treatment, were isolated from the main herd. About 3 months later they were returned to the main herd and treated.

Diagnostic methods used were: (a) udder palpations, (b) daily strip cup tests, (c) microscopic examination of incubated samples for types of bacteria and numbers of leucocytes, and (d) growth of organisms on blood agar followed by identification of streptococci and coagulase tests on staphylococci.

With the exception of a few of the first cases, the dosage of penicillin was standardized at 100,000 Oxford Units per treatment per quarter. This was dissolved in 100 ml. of sterile distilled water and was infused into the udder by gravity. Eighty-seven quarters were treated during the first year and 28 during the second year. Quarter samples were examined at monthly intervals during the first year and at quarterly intervals during the second year. The progress of all treatments was followed bacteriologically a few days after the injection of penicillin and at the regular samplings as long as the cow remained in the herd. The data reported below do not include the work done since January 1, 1947.

Of 73 quarters treated for *Streptococcus agalactiae,* 77.7 per cent became negative to this organism for one month or longer; however, 50 per cent of these "cured" cases again became positive to this organism at varying time intervals, averaging 5.9 months.

When the treatments for *S. agalactiae* are divided into cases of recent infection (found on one examination only) and those of longer duration, the data show 90 per cent "cures" in the first group and only 59 per cent in the latter.

S. agalactiae were found in routine samplings of 37 quarters not treated. No attempt was made to select these cases. The majority of these occurred during a period of about 6 months (the first half of the second year) in which no penicillin was used; a few cases occurred during the first year. Of these 37 quarters not treated, 43.3 per cent became negative to *S. agalactiae.* When these cases are divided into those which were positive only once in routine examinations and those of longer duration, 65.2 per cent became negative in the first group and only 7.1 per cent in the latter group. This suggests that in some of the cases in which *S. agalactiae* was found the infection was not firmly established.

Eighteen quarters positive for staphylococci were treated with penicillin. Some of these quarters were treated several times. Only 50 per cent of these became negative to the organism, and 44.4 per cent of these "cures" again were positive after an average time elapse of 1.5 months.

Staphylococci were found in routine samplings of 93 quarters not treated; 76.4 per cent of these became negative to this organism. When these cases are divided into those in which the organism was found in only one sampling and those of longer duration, 83.8 per cent in the first group became negative and 47.4 per cent in the second group. Apparently many of these cases were not firmly established infections.

P29 The Use of Quaternary Ammonium Compounds for Washing the Udders of Dairy Cows. ROBERT H. KEITH AND PAUL M. REAVES, Dairy Husbandry Department, Virginia Polytechnic Institute.

Recently a number of quaternary ammonium compounds effective in the sterilization of dairy utensils have been developed. In order to study their value in washing the udders of dairy cows just prior to milking, these products were compared with chlorine and with a plain water wash. The results indicate that they are effective as sanitizing agents. They also appear not to cause the hands of the milker or the teats of the cow to chap, as chlorine often does when used in hot water and especially in cold weather. Emulsept, Hyamine T, B T C, and Roccal were used in these trials.

P30 The Effect of Reduced Feed Intake on Mammary Growth and Lactation. J. F. SYKES, T. R. WRENN, AND S. R. HALL, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

The effect on mammary growth and subsequent lactation of restricting a group of rats to 70 per cent of the feed consumption of litter mates fed *ad libitum* during the growing period and through pregnancy has been studied. At parturition mammary glands were obtained from half of each group and the remaining half allowed to nurse litters for 21 days on full feed to correlate observed mammary growth at parturition with subsequent lactation.

The results obtained indicate that feed restriction during the growing period and pregnancy reduces the size of the mammary gland out of proportion to the reduction in body size. However, if access to sufficient feed is allowed after parturition, a rapid growth takes place and the glands actually may lactate more efficiently than those which were better developed at parturition.

P31 Further Studies on the Effect of Vitamin D and of Parathyroid Extract, "Paroidin", on the Blood Changes of Normal and Milk-

Fever Cows at Parturition. J. W. HIBBS, W. D. POUNDEN, AND W. E. KRAUSS, Ohio State University.

Previous experiments have shown that the administration of from 2 to 5 million units of vitamin D daily, in the form of irradiated dry yeast or "Viosterol," for from 2 to 4 weeks prepartum will increase serum calcium and phosphorus at parturition. However, the increases thus obtained are nullified completely in both normal and milk-fever cows within 12 hours postpartum, or before milk fever usually occurs. No lowering of milk fever incidence could be demonstrated in these experiments.

The possibility was recognized that the previous vitamin D feeding periods might have been too long. The feeding of vitamin D for extended periods of time is known to suppress parathyroid activity. Experiments in which the increases in serum calcium and phosphorus were followed closely after the initiation of vitamin D feeding to non-parturient cows showed that a peak is reached in from 10 days to 2 weeks. Therefore it was decided to study the effect on the blood serum calcium and phosphorus of feeding massive doses of vitamin D (10 million units daily) beginning 5 to 7 days prepartum. The serum calcium and phosphorus thus would be increasing at parturition and possibly the calcemic action of vitamin D would not be masked by parathyroid suppression.

Results to date, although the numbers are few, indicate that the serum calcium and phosphorus were increased at parturition, and that the usual postpartum decrease was slight as compared to the control cows when this system of vitamin D supplementation was used.

Parathyroid extract, "Paroidin", when injected subcutaneously into non-parturient cows in single doses of from 2 to 3 thousand units, regularly caused an increase of from 1.5 to 2 mg. per 100 ml. in serum calcium and phosphorus, reaching a maximum in from 15 to 20 hours after injection.

When 3, 4, and 5 thousand units, respectively, of "Paroidin" were administered to three cows with early milk fever symptoms, no benefit could be detected. A fourth cow was injected with parathyroid extract (4,000 units) and also was fed 10 million units of vitamin D on the day before parturition and again at the time of the injection. This cow was exhibiting mild early milk fever symptoms at the time of injection. She did not go down with milk fever, and the serum calcium remained constant at about 6.50 mg. per 100 ml. for about 24 hours. The serum calcium level was found to be normal after 48 hours.

It is believed that the failure to mobilize calcium from the skeletal reserves in milk fever is due either to a failure of the parathyroid glands to secrete sufficient hormone or to the situation in which sufficient hormone is secreted but is rendered temporarily inactive by some metabolic condition in the tissues at parturition.

Vitamin D yet may prove to be beneficial in the control of milk fever if a suitable dosage administered at the proper time can be determined.

P32 The Effect of the Quality and Quantity of Feed Prepartum and Postpartum upon Blood Glucose and Blood Acetone Bodies. J. C. SHAW AND G. M. CAIRNS, Maryland Agricultural Experiment Station.

Thirty cows were divided into six groups and placed on an experiment beginning 16 weeks prepartum and ending 4 weeks postpartum. All of the cows received 140 per cent of requirements during the first 8 weeks, 180 per cent during the second 8 weeks, and either 50 per cent postpartum for 3 weeks followed by 100 per cent or 100 per cent for the entire 4 weeks postpartum.

The rations fed were designed to study the influence of the fat, protein, soluble carbohydrate, and vitamin A content of the prepartal ration upon the postpartal level of blood glucose and blood acetone bodies.

While several of the cows developed a marked hypoglycemia, none exhibited ketonemia. The data provide conclusive evidence that a vitamin A deficiency in dairy cows does not produce ketosis even on fasting. A limited T.D.N. intake of 50 per cent postpartum produced hypoglycemia most frequently and of a greater severity in those cows in which the total T.D.N. requirements were greatest. The data also demonstrated that a deficiency of blood glucose alone is insufficient to produce ketosis. High soluble carbohydrate rations fed both prepartum and postpartum did not aid in preventing hypoglycemia. A high fat-low protein ration during the prepartal period, followed by limited feed intake postpartum, did not produce ketosis and did not result in any greater hypoglycemia than some of the other treatments.

The summarized results differ in some respects from those obtained at the University of Connecticut, where both hypoglycemia and ketonemia were observed (unpublished). However, in these experiments energy intake was maintained at 60 per cent of requirements for 2 weeks preceding parturition and at 50 per cent following parturition. Likewise, the latter animals may have been in somewhat better condition. While the blood acetone bodies may exhibit an inverse relationship to the blood glucose, such relationship does not hold under all conditions. This indicates that while energy intake undoubtedly plays a rôle in the development of ketosis, it is not the only factor involved and, indeed, may not be the most important factor.

P33 Vitamin A Deficiency in Dairy Cattle on Rations Containing Ground Raw Soybeans. J. C. SHAW, Maryland Agricultural Experiment Station, AND L. A. MOORE AND J. F. SYKES, Division

of Nutrition and Physiology, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

Twelve cows receiving a low-carotene timothy hay and a concentrate containing 40 per cent raw soybean meal for 4 months prepartum dropped calves showing signs and symptoms of a vitamin A deficiency. One cow exhibited incoordination and five retained their placentas. Four cows on a basal ration not containing soybean meal dropped two calves which appeared to be completely normal and two dead calves. There appeared to be no way of ascertaining whether the two calves died of a vitamin A deficiency. None of the four controls retained their placentas. All of the cows, both controls and normals, exhibited low levels of plasma vitamin A following parturition. The plasma vitamin A levels of the calves showed little or no increase after receiving colostrum milk from their dams for 5 days. The lowest plasma vitamin A levels were observed in calves whose dams received the soybean ration unsupplemented by vitamin A.

Five cows received the soybean ration for 4 months prepartum, supplemented by the feeding of 400,000 I.U. of a vitamin A concentrate for the last 4 weeks prepartum. Four of the five appeared to be normal at birth. The fifth appeared to be normal but died of bacteremia on the second day. The plasma vitamin A of the four calves increased markedly after receiving colostrum milk from their dams.

An additional experiment was conducted with calves to obtain further information on the possible detrimental effect of raw soybean meal when fed to dairy cattle on low levels of carotene intake. Four calves at 4 months of age were partially depleted of vitamin A on Moore's vitamin A-deficient ration, after which they received 32 μg. of carotene per day per pound of body weight. Two of the calves were continued on the basal ration and two received a similar ration to which raw soybean meal was added to the extent of 30 per cent. Blood plasma vitamin A was determined weekly and liver vitamin A was determined at the end of the experiment. The plasma vitamin A consistently was lower in the two calves receiving the ration containing the raw soybean meal, averaging 5.64 and 6.60 μg. per cent, whereas that of the control calves was 9.60 and 9.32. The liver vitamin A (wet basis) was 0.72 and 2.75 μg. per g., respectively, for the calves on the soybean ration and 9.07 and 9.22 μg. per g. for the calves on the basal ration.

P34 Values of Regular Corn Silage, Grainless Corn Silage and Ear Corn Silage in the Dairy Ration. K. M. DUNN, R. E. ELY, AND C. F. HUFFMAN, Michigan Agricultural Experiment Station.

Fifteen lactating cows depleted of unknown lactation factors were used in these studies. The method used to determine the relative feeding value of total digestible nutrients of various feeds was designed by Huffman (Jour. Dairy Sci., **21**: 101. 1938).

Results of the feeding trials indicated that grainless corn silage was equal to clover hay on a total digestible nutrient basis for milk production. When corn grain replaced grainless corn silage on a total digestible nutrient basis, there was a daily increase of 2.5 lb. of 4 per cent fat-corrected milk during the fourth 3-day period.

The replacement of part of the clover hay with ear-corn silage on a total digestible nutrient basis resulted in a significant increase in milk production. This increase reached its peak during the fifth 3-day period, at which time there was an average daily increase of 4.7 lb. of 4 per cent fat-corrected milk. The total digestible nutrients in ear-corn silage was equal to the total digestible nutrients in corn-and-cob meal for milk production.

When grainless corn silage plus corn-and-cob meal replaced regular corn silage, no significant change in milk production occurred. These data indicate the corn grain in corn silage is equal to dry corn grain stored in a crib for milk production.

Corn grain and ear-corn silage carried some unknown factor or factors that stimulated milk production. The clover hay used in these studies appeared to be low in these factors.

P35 Carotene Losses from Artificially Dehydrated Alfalfa and from Artificially Dehydrated Alfalfa Silage.[1] R. G. WASHBURN, W. E. KRAUSS, AND C. F. MONROE, Ohio Agricultural Experiment Station.

A study was made of the carotene losses from artificially dehydrated alfalfa meal and from the same material preserved as artificially dehydrated alfalfa silage.

In June, 1946, a field of alfalfa was divided into two parts. One part was field harvested, the crop immediately dehydrated in a commercial dehydrator, and then ground, sacked, and stored in a barn. The remaining part was ensiled with the addition of molasses. This silage remained in the silo until mid-December, 1946, when it was dehydrated, ground, and stored until the latter part of January, 1947.

The loss in carotene from the artificially dehydrated alfalfa meal, stored in the barn from July, 1946, to May, 1947, was 48 per cent. The alfalfa meal stored at the place of dehydration had a loss in carotene from July, 1946, to April, 1947, of 55.5 per cent.

The amount of carotene lost during the period that the alfalfa was ensiled and then dehydrated, *i.e.*, from June, 1946, until mid-December, 1946, was 30 per cent.

Although there was more carotene in dehydrated alfalfa silage than in stored dehydrated alfalfa meal, the physical characteristics of the dehy-

[1] The alfalfa meal and dehydrated silage were made and shipped to the Ohio Experiment Station by the Farm Bureau plant at Payne, Ohio.

drated silage were such as to question the advisability of attempting to preserve carotene in this way for the production of commercial alfalfa meal.

P36 Silage Density: Effect of Pressure and Crop Condition. A. E. PERKINS AND R. G. WASHBURN, Ohio State University.

Sixteen series of silo presses with 12 to 18 in each series have been filled and carried through an observation period of about 35 days. The crops used were corn or meadow crop mixtures in which alfalfa, clover, and timothy predominated.

Usually one material at three different degrees of dryness was cut uniformly. Weights of crops which supplied about the same amount of dry matter were packed lightly into the silo presses.

The initial depth was recorded and a series of weights, ranging from 1 to 16 lb. per sq. in. of silage surface simulating the pressures thought to prevail at different levels in farm silos, was applied to the material of each degree of dryness. These weights remained in place throughout the experimental period. Depth readings were taken daily at first and then at longer intervals. The occurrence of any leakage was noted.

The cross sectional area of the silo presses and the dry matter of the ensiled material were determined in advance. The volume and the density of the ensiled material as grams per cubic centimeter were calculated for each of the depth measurements and grouped for study. The following relationships were shown:

1. A greater total weight, but a smaller weight of dry matter, could be stored in a given space with a green than with a drier crop.

2. The volume shrinkage or increase of density was greater and more rapid with the green or wetter crops than with those which were drier or more mature.

3. The greatest increase in dry matter density was obtained in the case of crops of 35–40 per cent dry matter. The greatest absolute density of dry matter, however, was obtained in the driest group, that above 50 per cent dry matter.

4. When the results at all degrees of dryness were averaged to study the effect of varying pressure, the density increase was rather slow and small at 1 lb. per sq. in. pressure, less than 1 per cent for 1 day and only 9 per cent in 30 days. At 16 lb. per sq. in., the density increase was 53 per cent for 1 day and 93 per cent for 30 days.

5. Leakage from the ensiled material began when the density approached 0.9 g. per cc., or about 56 lb. per cu. ft.

6. The material remaining after extensive leakage at the higher pressures attained a density of 1.0 g. per cc., 62.5 lb. per cu. ft. or higher.

7. The dry matter density of silage at low-to-medium pressures is equal

to that of commercially baled hay, while silage at the higher pressures may contain twice as much dry matter per unit volume as baled hay.

8. Contrary to the prevailing idea, the difference in density between corn silage and hay crop silage at corresponding dry matter and pressure levels was small.

P37 The Comparative Feeding Value of Corn Silage and of Corn-treated Meadow Crop Silages, with and without the Addition of Dilute Acetic Acid. C. F. MONROE, A. E. PERKINS, C. E. KNOOP, AND R. C. THOMAS, Ohio State University.

Three silages were compared in a double reversal feeding trial which consisted of three periods of 35 days each. The silages were fed in six different sequences to a like number of outcome groups, each composed of one Jersey and two Holstein cows. With the exception of the kind of silage fed, all the cows received the same rations and general treatment.

All the silages were made by a forage crop harvester which cut and chopped the crops in the field. The corn silage was of moderately good quality, made from a grain variety of hybrid corn. Both of the meadow crop silages were made from the same mixture, consisting of 72 per cent timothy, 22 per cent clover and alfalfa, and the remainder of weeds and volunteer wheat. To both of these silages approximately 100 lb. of ground corn were added per ton of material as it was being blown into the silo. In addition, one of the silages was sprayed with a 12.5 per cent solution of acetic acid at the rate of 5 gallons per ton. This small addition of acetic acid, amounting to 0.25 per cent, was made in the hope of controlling the original fermentation and thereby improving the quality of the product. The silage resulting from this treatment was of good quality, but only slightly better than the one which received the corn treatment only. Both the meadow crop silages and the corn silage contained approximately 28 per cent dry matter.

The feed intakes were practically the same on all three of the silage rations. Likewise, the productions showed no significant differences. The average productions of 4 per cent milk (F.C.M.) for 28 days were as follows: On corn silage, 777.4 lb.; on corn-treated meadow crop silage, 777.9 lb.; and on corn and acetic acid treated meadow crop silage, 776.5 lb.

The carotene and vitamin A contents of the milk produced on the three silages showed little difference, although the meadow crop silages supplied from two to three times as much carotene as the corn silage. This lack of difference may have been due to the shortness of the feeding periods.

P38 The Digestibility of Coarsely Ground and Finely Ground Alfalfa for Dairy Heifers.[1] ERIC W. SWANSON AND A. C. RAGSDALE, Department of Dairy Husbandry, University of Missouri.

[1] Contribution from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series no. 1050.

In the course of metabolism and digestibility studies with various feeds, it was noted that dairy heifers nearly ceased ruminating on certain rations containing finely ground roughage. This suggested a study of the effect of suppressed rumination upon digestibility. Alfalfa hay of medium quality, ground or chopped into three different degrees of fineness, was fed. Digestion coefficients were determined with 16-month-old dairy heifers. Rumination was normal on the coarse hay, noticeably depressed on the medium ground hay, and not observed on the finely ground hay. No undesirable effects were observed on any of the rations, and no significant differences were found between the rations in regard to digestion coefficients of total organic matter, total dry matter, or total digestible nutrients. The average T.D.N. was 53.48 ± 1.23 per cent for the finely ground, 52.01 ± 0.14 per cent for the medium ground, and 53.35 ± 0.70 per cent for the coarsely chopped alfalfa. Differences among the rations in the digestion coefficients of ether extract and crude fiber likewise were not significant. The digestion coefficient of nitrogen-free extract for the medium ground hay was significantly lower than for either the finely ground or coarse chopped hay. Protein digestibility also was lower for the medium ground hay than for the other two, but the differences were of doubtful significance. The results of the experiment would indicate that grinding alfalfa hay fine enough seriously to affect rumination does not alter the digestibility. The data suggest that rumination may not be essential to proper digestion of roughage provided it is fine enough not to require remastication.

P39 Drying Requirements, Losses Caused by Drying, and Quality of Forage Obtained in Mow Hay-drying Experiments at Beltsville.

J. B. SHEPHERD, H. G. WISEMAN, AND C. G. MELIN, Bureau of Dairy Industry; L. G. SCHOENLEBER, Bureau of Plant Industry, Soils and Agricultural Engineering; AND W. H HOSTERMAN, Production and Marketing Administration; U. S. Department of Agriculture.

Seven experimental lots of alfalfa or of mixtures of alfalfa, Ladino clover, and bluegrass, and two lots of a mixture of orchard grass and Ladino clover were dried on barn-sized mow hay finishers. Four lots were dried long and three were dried chopped, using 15 to 16 cu. ft. of unheated air per minute per square foot of floor area. Two lots of long hay, one loose and one field-baled, were dried with different quantities of air and supplemental heat. No rainfall occurred between cutting and storage of any lot. The fan was operated almost continuously during the first 3 or 4 days of drying. The weather during drying was indifferent, and in some cases was poor for drying.

All lots on which leaf determinations were made were either leafy or

extra leafy. The drying time was shortest, nutrient losses lowest, and the quality the highest when hay was stored with a low moisture content and dried in medium or shallow depths or dried with supplemental heat. Drying time and nutrient losses increased, and the aroma, green color, and carotene content decreased as the moisture content of the hay increased and as the depth to which it was stored increased. Static pressures increased as the moisture content and the depth of hay increased. Fan use (per ton of dry matter preserved), supplying air at a uniform rate, was lowest with hays having low to moderate moisture contents, with hays stored at medium to deep depths, and with hays dried with supplemental heat; it was highest with hays having high moisture contents, hays stored at shallow depth, and hays dried with unheated air. Electricity consumption (per ton of dry matter preserved) was lowest for hay with low to moderate moisture content and for medium depths of hay, and highest with hay having a high moisture content and with hay stored at deep or very shallow depths.

Samples taken at different depths after drying indicate that the green color and carotene content of the hay is greater at the bottom of the pile, which dries first, than at the top of the pile, which dries last. Carotene determinations made on various dates after drying show that there is a continuous and considerable loss of carotene throughout the storage period from drying to feeding.

The most feed was preserved and the best quality of hay was produced when the hays were dried in a week or less. Losses usually were moderate and the feeding quality very satisfactory when the hay was dried within 10 or 11 days.

Drying the hay down as much as possible in favorable weather without leaf shattering, limiting the quantity of hay to a reasonable depth, and using plenty of air in drying are recommended practices.

The total weight of water in the hay was the principal factor affecting the length of the drying period, the losses from drying, and the quality of the hay.

P40 Grazing Management Studies of Orchard Grass-Ladino Clover.

P. S. Williams, V. G. Sprague, C. B. Knodt, and K. M. Autrey, Department of Dairy Husbandry, Pennsylvania State College, and the U. S. Regional Pasture Laboratory, State College, Pennsylvania.

A study is being conducted to determine the effects of different methods of grazing management upon the maintenance of clover and upon the digestible nutrient production of orchard grass-Ladino clover association. A field of orchard grass-Ladino clover which was established during 1944 was divided in the spring of 1945 into 15 plots approximately 0.7 of an acre in size. Five methods of management were randomized in three replications.

To determine the digestible nutrients produced, the plots were grazed according to the herbage present and the designated grazing scheme for that plot irrespective of the condition of the other replicates of the same treatment. In addition four samples of herbage were harvested with a mower from each plot just before the cattle were turned in for grazing. These samples were used to determine the dry matter yields, chemical composition of the forage, and the botanical composition of the sward.

The digestible nutrient production from grazing of the various plots was determined by calculation of maintenance requirements, gains and losses in body weight, milk production, and barn feed intake of the cows while they grazed each plot, according to the methods recommended by the Joint Pasture Committee.

The mean plot production during 2 years in terms of digestible nutrients obtained from grazing on the basis of the pounds per acre per treatment were as follows:

I Early spring grazing, followed by rotational grazing, 2,930
II Deferred spring grazing, followed by rotational grazing, 4,005
III Early spring grazing, second crop cut for hay or silage and subsequent crops rotationally grazed, 3,460
IV First crop cut for silage, subsequent crops rotationally grazed, 2,896
V Continuous grazing, 3.159

While the mean production from the plots under deferred grazing was somewhat more than from those under other methods of management, a statistical analysis of the data for the first 2 years indicated no significant differences in digestible nutrient production between treatments, between plots, or between years under the conditions of this experiment. Decreases in the clover content of the sward have occurred under certain of the grazing management treatments, and accordingly changes in the relative production of the various plots may be expected in subsequent years.

P41 The Evaluation of Several Grass-Legume Mixtures for Grass Silage and Aftermath Grazing. C. B. KNODT, V. G. SPRAGUE, P. S. WILLIAMS, AND K. M. AUTREY, Department of Dairy Husbandry, Pennsylvania State College, and the U. S. Regional Pasture Laboratory, State College, Pennsylvania.

One of the most important pasture problems in the Northeastern United States is to provide nutritious herbage during midsummer. Since permanent pastures provide adequate grazing during the spring, the first crop from semi-permanent pasture is most valuable for hay or silage and the aftermath is grazed. In an effort to obtain information on the relative productivity of five associations of grasses and legumes throughout the

midsummer months, three replicate plots of approximately 0.3 acre in size of each of the associations were seeded in the spring of 1944. The first crop was harvested for silage when the grass was in the early head stage in the Ladino associations and from the alfalfa plots when the legume was in about the one-tenth bloom stage. The aftermath from all plots was grazed rotationally. The frequency of grazing was determined by the amount of herbage present on an individual plot and its stage of growth, irrespective of the condition of the other replicates or plots of the other associations in the study.

The digestible nutrient production from grazing of the various plots was determined by calculation of maintenance requirements, gains and losses in body weight, milk production, and barn feed intake of the cows while they grazed each plot according to the methods recommended by the Joint Pasture Committee. The following digestible nutrient production was obtained from the various associations during the first 2 years of the experiment (expressed as pounds of digestible nutrients per acre):

	Grass-legume association	*Silage*	*Grazing*	*Total*
I	Orchard grass-Ladino	2055	2439	4494
II	Orchard grass-alfalfa	2201	3212	5413
III	Bromegrass-alfalfa	3022	1730	4752
IV	Bromegrass-Ladino	2260	1826	4086
V	Timothy grass-Ladino	2386	1900	4286

The 2-year averages obtained suggest that the bromegrass-alfalfa combination excelled in production of silage and that the orchard grass-alfalfa and orchard grass-Ladino clover associations provided the greater aftermath grazing. However, a statistical analysis of the data failed to reveal significant differences.

P42 The Influence of Thyroprotein in the Ration of Dairy Cattle.[1]

RALPH P. REECE, New Jersey Agricultural Experiment Station.

Eight dairy cows, past their lactational peaks, received 15 g. of thyroprotein daily for various periods of time (3 to 8.5 months). The average increase in milk production from the week prior to thyroprotein feeding to the highest subsequent weekly production was 24.8 per cent (range 7.9 to 36.2). The fat content of the milk was increased initially in every instance; however, in one case it eventually decreased to a level below that observed prior to thyroprotein feeding.

Two cows (621 and 652) received 15 g. of thyroprotein daily for 10 weeks. Based on weekly averages, milk production of cow 621 increased from 30.7 to 40.0 lb. per day, and that of cow 652 increased from 23.4 to

[1] Journal Series Paper of the New Jersey Agricultural Experiment Station, Rutgers University, Department of Dairy Husbandry.

31.6 lb. per day. The blood sugar level of the first cow increased from 36 to 53 mg. per cent in the second week of thyroprotein feeding; that of cow 652 increased from 38 to 55 mg. per cent. From the second week to the end of the thyroprotein feeding period, blood sugar levels remained rather constant; however, this did not prevent a decline in milk production.

Thyroprotein was administered to four cows with ketosis. An Ayrshire cow that had calved normally had increased in milk production until the beginning of the third week following calving. After that time milk production declined and a qualitative test on the urine for ketone bodies was positive (4+). Fifteen grams of thyroprotein were fed daily, and milk production, based on weekly averages, increased from 42.4 to 59.6 lb. per day. A Jersey cow in which ketosis had developed to a stage where feed was not being consumed failed to respond to thyroprotein administered orally in a capsule. Another Jersey cow showed symptoms of ketosis in the second week after calving. Milk production declined slightly, feed was not being eaten well, blood sugar level was low (26 mg. per cent), and a qualitative test on the urine for ketone bodies was positive (3+). The daily feeding of 15 g. of thyroprotein resulted in an increase in milk production and in blood sugar level (to 45 mg. per cent), and the qualitative test for urinary ketone bodies became negative. The gradual withdrawal of thyroprotein from the ration resulted in only a slight decrease in milk production and in blood sugar level. A Guernsey cow, 3 days after calving, had a low blood sugar level (20 mg. per cent) and gave a positive qualitative test for urinary ketone bodies. She responded to thyroprotein therapy, and thyroprotein successfully was withdrawn from the ration after a 32-day feeding period.

P43 Some Effects of Feeding Thyroprotein to Dairy Cows. J. W. THOMAS AND L. A. MOORE, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

The effects of feeding thyroprotein to producing dairy cows during the lifetime of the cow are under study at the Agricultural Research Center, Beltsville. Last year it was reported that cows which received thyroprotein and were fed total digestible nutrients according to Morrison's standard showed excessive losses in body weight. Further weight losses were checked by increasing the T.D.N. intake 25 per cent above the Morrison standard. Since then two heifers in their first lactation have received T.D.N. at the rate of 125 per cent of Morrison's standard throughout the thyroprotein-feeding period. Under these conditions no abnormal weight losses were noted and the stimulus to milk production was sustained throughout the entire lactation.

All cows in their second lactation have received T.D.N. at the rate of 125 per cent of the Morrison standard throughout the thyroprotein-feeding

period. Some have responded with a sustained increase in milk production while others, after the initial increase, have declined at approximately a normal rate. Most cows responded with an increased butterfat percentage in their milk when thyroprotein was fed.

Heart rates have been observed by means of a stethoscope. Heart rates were increased markedly by feeding the extra T.D.N. along with thyroprotein. Generally the heart rate increased with the increased milk production and decreased when the cow's production decreased. This parallelism also has been noted in cows fed normally. More cases of heart murmurs occurred among the thyroprotein-fed cows than among the other cows. During the second lactation of thyroprotein feeding some of the cows have shown an abnormal sinus arrhythmia, which has been verified by electrocardiograph records.

Eight cows have calved after receiving thyroprotein in their first lactation and one cow has calved after receiving thyroprotein in two lactations. The condition of the cows and all the calves has been normal. The Jersey cows always have conceived after one or two services. Some of the Holstein cows have shown irregular estrus periods and/or have required more than three services in order to conceive. The experiment is being continued to determine the effects of feeding thyroprotein during the lifetime of the cow.

P44 The Effect of Thyroprotein and Feed Intake on the Heart Rate of Dairy Steers. J. F. SYKES, T. R. WRENN, L. A. MOORE, AND J. W. THOMAS, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

The effects of variations in feed intake with and without thyroprotein have been studied in four dairy steers. The data show that increases in feed intake above normal standards increased heart rate and reduction in feed decreased heart rate. Thyroprotein increased heart rate to about the same extent whether the animals were on a high or low level of feed intake, but the absolute heart rates observed were greater on the high level than on the reduced level of intake.

When considered in conjunction with data previously reported on the effect of thyroprotein on milk production, these data suggest that thyroprotein can be effective in increasing milk production only when sufficient extra feed is present to maintain the heart rate above normal levels. Unless feed in excess of accepted standards is given, there may be a gradual depletion of body stores under the influence of thyroprotein until the cow actually may be underfed and milk production be depressed.

P45 Further Observations on the Effects of Feeding Thyroprotein to Dairy Cows. A. H. VANLANDINGHAM, GEORGE HYATT, JR.,

CHARLES E. WEAKLEY, JR., AND H. O. HENDERSON, West Virginia Agricultural Experiment Station.

Previous reports on the feeding of thyroprotein have been made (Jour. Dairy Sci., **27**: 385. 1944; *ibid.*, **29**: 533. 1946).

Thyroprotein (protomone) has been fed to a group of three Jersey and four Holstein cows with one or more lactations completed, beginning the second or third month of lactation and continuing the remainder of the lactation period. Jerseys were fed 15 g. and Holsteins 20 g. of protomone daily. The cows were started on protomone feeding during the winter months and continued through spring to early summer; they were on pasture in season. Protomone was not fed during the dry period. All cows except one Holstein were with calf when protomone feeding was started. Three of the cows, two Jerseys and one Holstein, are approaching the end of the second lactation period on protomone.

All cows calving have dropped normal calves after protomone was fed during the latter part of the previous lactation period. However, there is some indication that cows may be slower to get with calf following the feeding of protomone during the previous lactation. The most noticeable reaction to protomone feeding was the thin condition and loss in body weight after several months of feeding. Increased heart beat and respiration rate, observed at first, seem to approach normal after several months' feeding when the cows were fed in proportion to milk and fat production.

Ascorbic acid in the milk of the Jersey fed protomone was significantly lower than in a similar group not fed protomone. The ascorbic acid in the milk of Holstein cows fed protomone was somewhat lower than in the milk of a control group, but the difference was not significant. Ascorbic acid in the milk of Jersey cows not fed protomone was significantly higher than that of the Holsteins. Ascorbic acid in the milk decreased toward the latter part of the lactation period. Protomone did not affect the ascorbic acid content of blood plasma.

P46 Absorption and Elimination of Thiouracil in Ruminants. R. E. ELY, K. J. OLSON, AND E. P. REINEKE, Michigan Agricultural Experiment Station.

Absorption and elimination of thiouracil after subcutaneous and oral administration to goats and calves has been studied. Blood plasma thiouracil levels have been determined during continued administration of effective levels of thiouracil to goats and calves by subcutaneous and oral routes.

Maximum blood plasma thiouracil concentrations were reached in 4 to 8 hours after oral administration of thiouracil to goats. The plasma values are approximately proportional to the dosage of thiouracil when administered at the rate of 0.015, 0.03, 0.06, and 0.12 g. per kg. of body weight. The

thiouracil was practically eliminated from the blood plasma in 12 hours at the lower dosage level and in 24 hours at the high dosage level.

Subcutaneous administration of thiouracil to goats gave maximum plasma concentrations in 2 to 4 hours; the compound was eliminated from the plasma quite rapidly. Subcutaneous administrations gave approximately twice the maximum blood plasma thiouracil concentrations as comparable oral dosages. Subcutaneous and oral administration of thiouracil to calves gave similar absorption and elimination curves.

Studies of continued administration of thiouracil to goats and calves indicate that 0.1 g. of thiouracil daily per kg. of body weight administered subcutaneously at 12-hour intervals maintained effective blood plasma thiouracil concentrations. Oral administration of 0.2 g. of thiouracil daily per kg. of body weight at 12-hour intervals also maintained effective blood plasma thiouracil concentrations in goats and calves.

P47 The Influence of Thiouracil on Mammary Lobule-Alveolar Growth in Mice. JOHN P. MIXNER, New Jersey Agricultural Experiment Station.

Thyroidectomy has been observed to decrease the mammary lobule-alveolar growth responses of castrate virgin female mice to injected progesterone and estrone. A group of chemicals related to thiouracil induces the hypothyroid state in animals by inhibiting the synthesis of thyroxine by the thyroid gland. Thus it might be expected that thiouracil also might inhibit mammary responses in mice in a manner similar to that caused by thyroidectomy.

Ovariectomized virgin female mice were used in these experiments and the criteria of response were both the degree of lobule-alveolar growth obtained and the per cent of mice showing mammary lobule-alveolar growth responses. Anterior pituitary extract plus estrone and progesterone plus estrone were given as substances stimulating mammary growth. Thiouracil was given to certain groups of mice as 0.1 per cent of the ration for 2 weeks preceding the experimental period and was continued through the 10 days of the experimental injection period. The animals were ovariectomized immediately preceding the injection period.

Thiouracil decreased markedly both the degree of mammary lobule-alveolar growth and the percentage of mice showing mammary lobule-alveolar growth responses in the group injected with progesterone plus estrone and that injected with anterior pituitary extract plus estrone.

It may be concluded that thiouracil acts in a manner similar to thyroidectomy in decreasing the responsiveness of the mammary gland to exogenous mammary growth stimulating substances.

P48 Factors Influencing the Male Hormone Content of Cow Manure.[1]
C. W. TURNER, Missouri Agricultural Experiment Station.

In continuing the study of the androgenic (male) hormone content of dairy cattle manure during the past year, samples were collected from 30 dairy cows in various stages of lactation. Of these cows 18 were Holsteins, 8 were Jerseys, and 4 were Guernseys. The manure was dried in an electric oven at 45° C. and ground in a small hammer mill. The hormone content of the sample of manure was assayed by feeding it, as 10 per cent of the ration, to about 20 White Rock chicks for 28 days. The combs then were removed and weighed. The average weight of combs of the two sexes was divided by two.

For comparison with the experimental results, a group of similar control chicks has been run to determine the extent of seasonal variation in the normal chick-comb weight. Evidence of seasonal variation is appearing. The average normal comb weight during the 7-month period from September to March was 70.9 mg. Chicks fed 20 mg. methyl testosterone per kilo feed had combs averaging 319.3 mg. during the same 7-month period. It is planned to correct all data for seasonal variation. However, the results presented are uncorrected.

The average comb weight of the chicks fed 11 samples of manure from lactating Jersey cows was 189.62 mg., with a variation from 123 to 280. Seven samples from Guernsey cows averaged 160.4 mg., with a variation from 100 to 239 mg. The 32 samples of manure from lactating Holstein cows averaged 145.3 mg., varying from 71 to 233 mg.

The content of male hormone seems to be excreted in highest amount a few days before parturition and during the first month of lactation. After the first month the hormone content is reduced but remains fairly constant for much of the lactation period. Breeding lactating cows does not appear to cause any marked effect. If cows go dry for several months before the next parturition, the hormone content tends to be lower until the preparturient rise occurs.

Considering the many variable factors observed, the data available at this time can be considered only suggestive. Much further work is required.

P49 Progress Report in the Study of Certain Goitrogens.[2]
G. W. PIPES AND C. W. TURNER, Missouri Agricultural Experiment Station.

In view of the possibilities of the more active goitrogens as fattening agents for dairy calves and other livestock, a study has been made of the

[1] Contribution from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series no. 1049.

[2] Contributions from the Department of Dairy Husbandry, Missouri Agricultural Experiment Station, Journal Series no. 1048.

concentrations of thiouracil, 6-n-propyl thiouracil, and thiobarbital (5,5-diethyl-2-thiobarbituric acid) in the blood and tissues of several species of domestic animals during oral administration.

The same general pattern of rapid absorption from the digestive tract into the blood stream and speedy elimination from the blood and tissues has been observed in the domestic fowl, rabbit, goat, sheep, and calf. Significantly higher blood levels were produced and maintained in the blood stream of the fowl and the goat by thiobarbital than by any of the other goitrogens which were investigated.

Two 125-lb. Holstein calves were given 2 g. of thiouracil by capsule at 12-hour intervals. Thiouracil concentrations in the blood were determined at intervals during a 24-hour period. It was found that a uniform level could be maintained in the blood.

Thiouracil and thiobarbital concentrations in the tissues of animals receiving these goitrogens have been determined by a biological assay based on hypertrophy of the rat thyroid. Meat from animals receiving goitrogens, when fed to rats as 95 per cent of the diet, produced an almost imperceptible increase in thyroid size. The goitrogenicity of all tissues studied was less than that produced by the addition of 5 mg. of thiouracil per 100 mg. of normal tissue.

P50 The Effect of the Interval between Washing of the Udder and Attachment of Milking Machines upon the Bacterial Flora and Milk Production of Dairy Cows. C. B. KNODT, J. J. REID, P. S. WILLIAMS, AND E. M. KESLER, Department of Dairy Husbandry and the Department of Bacteriology, Pennsylvania State College.

During recent years considerable emphasis has been placed upon the importance of managed milking of dairy cows. The newer methods of milking not only save time but also are believed to increase milk production and to decrease the incidence of mastitis. Many dairymen do not attach milking machines during the recommended time after washing the cow's udder because of milking parlor arrangements or for other reasons. Accordingly, studies were conducted to determine what effect delay in attaching milking machines after washing the cow's udder might have upon milk production and the bacterial flora of the udder. All cows in the experiments were milked twice daily and machine stripped. The udders were washed carefully with water at 125 to 130° F. for approximately 15 seconds each. Two large streams of milk were removed from each teat following the washing. Use of the strip cup gave no evidence of any difference in the response of any of the groups. The cows were fed and managed similarly.

Thirty cows, with an average daily production of 51.19 lb., were divided into five similar groups on the basis of milk and milk fat production, stage of gestation, and stage of lactation. The milking machines were attached

2, 4, 6, 8, and 10 minutes after the washing was started. Statistical analysis of the milk production of the groups during the 35 days of this trial demonstrated no significant difference between treatments. The apparent change in bacterial flora of the udder was characterized by the appearance of β-hemolytic streptococci and long chain alpha and gamma streptococci in those groups where milking was delayed more than 4 minutes after the beginning of washing.

Because of the need for cows on certain pasture management projects, only 12 of the cows (four in each interval of 2, 6, and 10 minutes) were continued for an additional 35 days. Statistical analysis of the data covering 70 days' milk production showed no significant differences resulting from the various treatments and no changes in the bacterial flora of the udders which could be related to treatments.

In another experiment, 20 cows, with an average daily milk production of 39.6 lb., were divided into four comparable groups on the same basis as in the previous trials. The time intervals used were 2, 5, 10, and 20 minutes. As in the previous experiments, no statistically significant differences could be found in milk production during the 90-day experimental period. While some changes were observed in the concentration of leucocytes of the milk of various cows, these were believed to be related to stage of lactation. No changes were observed in the bacterial flora of the udders of the cows in the third trial. Under the conditions of this experiment, there was no significant effect upon milk production of time intervals up to 20 minutes between the beginning of washing a cow's udder and attachment of the machines.

While in the first experiment it appeared that definite changes occurred in the udder bacterial flora by delaying milking longer than 4 minutes after washing the cows' udders, later experiments did not agree with this observation.

P51 The Riboflavin Content of Cow's Colostrum. T. S. SUTTON AND HAROLD E. KAESER, Ohio State University and Ohio Agricultural Experiment Station.

The content and total output of riboflavin in the colostrum and subsequent milk of 35 cows was determined for the first ten consecutive and the twentieth milkings. Five dairy breeds were included in the study. The calves were not allowed to nurse and the total production was milked out, weighed, and sampled for analysis. Riboflavin was determined fluorometrically.

The average riboflavin content in milligrams per liter was found to be: 6.15, 3.66, 2.44, 2.25, 2.20, 2.10, 1.98, 2.01, 1.96, 1.95, and 1.83 for the first ten and the twentieth milkings, respectively. The total output of riboflavin was: 33.1, 12.6, 12.2, 14.8, 14.5, 15.1, 14.5, 13.7, 14.6, 14.3, and 16.0 mg., respectively, for the first ten and the twentieth milkings.

Considerable individual variation in riboflavin composition was found. For example, the potency of the first milking varied from a high of 11.5 mg./l. to a low of 3.9 mg./l. Breed differences in the riboflavin content of colostrum and milk also are indicated.

The production of riboflavin deficiency in very young calves by Illinois investigators (Jour. Nutr., **33**: 263–270. 1947.) gives emphasis to the importance of colostrum and milk as a source of riboflavin in the nutrition of the young calf.

P52 Some Possible Relationships between Management, Fore-stomach Contents and Diarrhea in the Young Dairy Calf. W. D. POUNDEN AND J. W. HIBBS, Ohio State University.

The color of the feces of 24 new-born calves was brown or yellow for approximately the first week, depending somewhat on the duration of colostrum feeding or nursing period. A change to gray shades of yellow or white followed. At approximately 2 weeks of age another change to darker shades of gray brown or green occurred, apparently influenced by the type and quantity of dry feeds consumed. Although few calves had diarrhea during the first and third stages, all but one had periods of abnormally liquid feces for a few days during the second stage. Practically all recovered without the assistance of drugs.

The materials removable from the fore-stomachs by use of stomach tubes (inside diameter 7 mm.) increased considerably for a day or so in nine of ten Jersey calves between 7 and 10 days of age, and in eight Holstein calves between 6 and 9 days and again in six of them between 10 and 13 days of age. The quantity that could be removed depended on the volume present and the consistency. These ages are within the same age period during which diarrhea attacks were prevalent. In ten instances (among 19 calves) increases in rumen liquids coincided within a day with the appearance of diarrhea. Milk or curd was present in the rumen contents of eight of twelve 1-day old calves, but was observed on only 4 of 23 occasions at the time of increased removable materials. Diarrhea accompanied the latter and the calves were depressed. A reading of pH 4.43 was obtained on one of these curdy samples in contrast to pH 6.7, the average obtained for 43 samples from nine of the calves up to 10 days of age.

Rumen flora and fauna judged to be normal on the basis of the presence of organisms similar to those observed in cows developed in but five of fifteen calves within 30 days of birth and still were absent from the rumens of two of seventeen calves at 90 days of age. The two calves that suffered most from indigestion when placed exclusively on dry feed were classified as not having normal flora and fauna by 5 weeks of age. Five calves provided with organisms from mature animals by transfer of rumen contents or cuds were among those that progressed the most satisfactorily.

The limited nature of the observations precludes definite conclusions. However, indications are that it may be advisable to endeavor to limit the duration of the period when calves have the second type of feces. Perhaps this might be accomplished by extended colostrum feeding, coupled with early provision of suitable dry feeds along with rumen flora and fauna.

P53 The Effect of Feeding Various Levels of Vitamin A on the Depletion Time of Dairy Calves. W. C. JACOBSON, H. T. CONVERSE, AND L. A. MOORE, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

In order to study the time required for the depletion of the vitamin A stores of calves reared under natural conditions, two pregnant cows were turned on pasture early in the spring about 3 weeks before calving. The two heifer calves which they dropped were permitted to run with their dams on pasture from birth to 90 days of age. Thus, these two calves could obtain whatever quantity of summer whole milk they desired and, in addition, any green grass they would consume.

Male calves receiving colostrum milk for 3 days and a limited quantity of whole milk to 60 days of age, along with a grain mixture and U.S. no. 2 alfalfa hay, also were placed on experiment. The whole milk fed was from cows receiving winter rations. One calf out of each pair of calves received, in addition, various quantities of vitamin A in the form of cod-liver oil for various periods of time.

At 90 days of age all calves were placed on a vitamin A-deficient ration to determine how long it would take to deplete their stores of vitamin A. Stores were considered to be depleted when the vitamin A of the blood plasma decreased to a level of 4 μg. or less per 100 ml. of plasma.

The two calves which ran on pasture with their dams required up to 4 months for depletion, whereas calves which received no supplemental vitamin A and were reared according to present day methods of limited whole milk feeding required less than 30 days, in most cases, for the depletion period. Where 50,000 I.U. of vitamin A per day were fed for various periods of time, the depletion time was in proportion to the quantity of vitamin A fed.

P54 The Antirachitic Properties of Field-cured Hay, Barn-dried Hay, and Wilted Grass Silage when Fed to Calves. L. A. MOORE AND J. W. THOMAS, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

Exposure of hay to the rays of the sun during the curing process increases its vitamin D potency. In making barn-dried hay and wilted grass silage, the length of time the crop is exposed to the sun's rays is considerably

less than in making field-cured hay. Thus it might be reasoned that barn-dried hay and wilted silage contain less vitamin D than field-cured hay.

Roughage was put up as field-cured hay, barn-dried hay, and wilted silage, and each kind of roughage was fed to six dairy calves to study its antirachitic effect.

The ash analysis of the first 10 per cent of the epiphyseal ends of the seventh and eighth ribs did not reveal any particular differences between the calves fed the different roughages. In all three groups of calves, the rib ends of those that were fed at the lower roughage levels were lower in ash. There was some indication that the calves fed the barn-dried hay and the wilted silage showed more stiffness than the calves fed the field-cured hay. Calcium, phosphorus, and phosphatase determinations of the blood did not reveal any difference between the three groups.

Wilted silage made from the 1946 crop was fed to two calves, beginning at birth. The only other source of vitamin D which the calves received was from a limited quantity of whole milk fed to 60 days of age. One calf now is 5 and the other 7 months old, and there is no physical indication of developing rickets. The blood picture in both calves also has remained normal.

While further studies must be made, these results would indicate that where barn-dried hay and wilted grass silage are fed at the usual levels of roughage feeding (*i.e.*, 2 to 3 lb. of hay or its equivalent per 100 lb. of body weight), sufficient vitamin D is present to prevent rickets in growing calves.

P55 Changes in the Cell Volume and in the Concentration of Several Inorganic Constituents in the Blood of the Dairy Calf during Its Early Postnatal Development. G. H. WISE, M. J. CALDWELL, D. B. PARRISH, AND J. S. HUGHES, Kansas Agricultural Experiment Station.

Changes in cell volume, hemoglobin, calcium, magnesium, sodium, and potassium of whole blood and in calcium, magnesium, sodium, potassium, and inorganic phosphorus of blood serum from 11 individual dairy calves were observed during the normal dietary transitional stages from birth to effective hay ingestion. Blood samples were collected immediately after birth, daily during the colostral period, weekly from the first to the sixth week, and biweekly thereafter to 10 weeks of age.

Cell volume and hemoglobin decreased from birth to approximately 3 weeks of age but gradually increased thereafter, suggesting a response to hay ingestion. Though sodium revealed no striking change at any stage, the concentration in whole blood decreased from birth to 2 weeks of age, followed by a gradual increase. The significance of these changes is rather obscure. Potassium of whole blood declined throughout the first 8 weeks of postnatal life; that of the serum remained relatively uniform. In-

organic phosphorus of the blood serum increased during the first week but subsequently remained at a constant level. Though calcium of the whole blood and of the serum decreased after the period of colostrum consumption, the change is of doubtful significance. The magnesium concentrations were uniform throughout. The changes in the concentrations of these various constituents of the blood apparently were not affected to any marked degree by dietary changes.

P56 The Value of Distillers Dried Solubles and Dried Grains with Solubles in the Ration of Dairy Calves.[1] J. R. SCHABINGER AND C. B. KNODT, Department of Dairy Husbandry, Pennsylvania State College.

A total of 48 calves, purchased in Central Pennsylvania, were divided into six comparable groups on the basis of breed, sex, body weight, height at the withers, and circumference of the chest at the beginning of the trial. Because of the difficulties encountered in obtaining sufficient calves, two male and two female calves of each of the Holstein and Guernsey breeds were used in each group.

The following rations (in pounds) were utilized:

Group I (Basal) —(crushed oats, 650; corn meal, 595; wheat bran, 165; soybean oil meal, 250; linseed oil meal, 120; dried whey, 100; dried brewer's yeast, 60.)

Group II —(crushed oats, 650; corn meal, 595; wheat bran, 175; soybean oil meal, 250; linseed oil meal, 120; distillers dried solubles, 150.)

Group III—(crushed oats, 650; corn meal, 595; wheat bran, 145; soybean oil meal, 250; distillers dried solubles, 300.)

Group IV —(crushed oats, 650; corn meal, 595; wheat bran, 245; soybean oil meal, 250; distillers dried solubles, 150; redfish meal, 50.)

Group V —(crushed oats, 650; corn meal, 595; wheat bran, 175; soybean oil meal, 250; linseed oil meal, 120; distillers dried grains with solubles, 150.)

Group VI —(crushed oats, 650; corn meal, 595; wheat bran, 145; soybean oil meal, 250; distillers dried grains with solubles, 300.)

In addition, all rations contained steamed bone meal, 25 lb.; ground limestone, 15 lb.; salt, 10 lb.; vitamin A oil (containing 3,330 U.S.P. units per g.), 9 lb.; and irradiated yeast, 1 lb.

All calves were fed 300 lb. of whole milk during the first 45 days on the trial. Mixed hay (timothy and Ladino clover) was before the calves at all times until they were 2 months of age, after which they were fed a good quality alfalfa hay *ad libitum* throughout the remaining 6-month period.

[1] This work was supported in part by Schenley Distillers Corporation, N. Y., N. Y., and by the Flory Milling Company, Bangor, Pennsylvania.

During the course of the trial the following losses, due to pneumonia and enteritis, were incurred: Group I, 1 Holstein female; Group II, none; Group III, 1 Guernsey female, 2 Guernsey males; Group IV, 1 Guernsey female, 2 Guernsey males; Group V, 1 Guernsey female, 1 Holstein male; and Group VI, 1 Guernsey female.

The following mean daily gains in body weights, for the calves surviving the trial, were observed during the 6-month feeding period (per cent = per cent normal, Mo. Agr. Expt. Sta. Bul. 336.): Group I, 1.42 lb. (102.3 per cent); Group II, 1.46 lb. (109.3 per cent); Group III, 1.48 lb. (98.8 per cent); Group IV, 1.42 lb. (93.7 per cent); Group V, 1.41 lb. (102.1 per cent); and Group VI, 1.50 lb. (104.6 per cent). The mean daily growth rates in terms of height of the withers were as follows (per cent = per cent normal, Mo. Agr. Expt. Sta. Bul. 336.): Group I, 0.135 cm. (91.3 per cent); Group II, 0.131 cm. (85.8 per cent); Group III, 0.136 cm. (91.0 per cent); Group IV, 0.132 cm. (88.4 per cent); Group V, 0.124 cm. (85.7 per cent); and Group VI, 0.133 cm. (90.1 per cent). The mean daily growths, measured in terms of circumference of the chest, were as follows: Group I, 0.23 cm.; Group II, 0.25 cm.; Group III, 0.22 cm.; Group IV, 0.23 cm.; Group V, 0.23 cm; and Group VI, 0.25 cm. Careful observation of the data reveals that the variation between calves within groups was as great as the variation between groups when gains in body weight, height at the withers, and circumference of the chest are considered as criteria of growth. Accordingly, it appears under the conditions of this experiment that distillers dried solubles and distillers dried grains with solubles may replace satisfactory linseed meal, dried brewer's yeast, and dried whey in the rations of dairy calves.

P57 The Utilization of β-Carotene, Vitamin A Alcohol, and the Natural Ester of Vitamin A by Holstein Heifers.[1] R. H. Ross, C. B. Knodt, and N. B. Guerrant, Departments of Dairy Husbandry, and Agricultural and Biological Chemistry, Pennsylvania State College.

Six Holstein heifers between the ages of 12 and 15 months were used in an experiment to determine the relative efficiency of utilization of β-carotene, the natural ester of vitamin A, and vitamin A alcohol. The heifers were fed throughout the trials oat straw *ad libitum* and 10 lb. per day of a concentrate mixture containing 200 lb. of oat feed, 200 lb. ground oats, 100 lb. peanut bran, 125 lb. soybean oil meal, 10 lb. steamed bone meal, 7 lb. salt, and 0.5 lb. irradiated yeast. When the blood plasma vitamin A levels were reduced to 6–8 μg. per 100 ml., the heifers were divided into three similar pairs on the basis of body weight, age, and blood plasma vitamin A concentrations.

[1] This work was supported in part by The Borden Company, N. Y., N. Y.

The three sources of vitamin A then were administered in capsule form for 20 days at the rate of 100 U.S.P. units per kg. of body weight per day. After each of the first two periods of administration, the heifers again were depleted and the supplementation rotated so that after three feeding periods all six heifers had received the three sources of vitamin A for a 20-day period.

Daily blood samples were taken during the periods of administration except during the last half of the first trial, when they were taken every other day. In analyzing the data representing the blood plasma vitamin A determinations for the three treatments by an analysis of variance, a highly significant difference was found between the treatments and between days of supplementation. The difference between heifers approached significance. It was determined that no significant difference existed in the blood plasma vitamin A levels of heifers during the administration of vitamin A alcohol or the natural ester of vitamin A. However, both produced a higher level (highly significant) of blood plasma vitamin A than did β-carotene. The following mean concentrations of blood plasma vitamin A (μg. per 100 ml.) were found during the feeding periods: β-carotene feeding, 6.95; vitamin A alcohol feeding, 10.77; and the natural ester of vitamin A feeding, 10.83 [t (0.01) = 2.846].

In an analysis of variance of the determinations of blood plasma carotene of the heifers on the three treatments, a highly significant difference was found between treatments and between days on supplementation, but no significant difference was found between heifers. The following mean concentrations of blood plasma carotene (μg. per 100 ml.) were determined during the feeding periods: β-carotene administration, 67.42; vitamin A alcohol administration, 43.59; and the natural ester of vitamin A administration, 49.28 [t (0.01) = 19.05]. On the basis of the least significant mean difference required for significance, it was found that feeding carotene increased the blood plasma concentration of carotene above (highly significant) that of the heifers receiving vitamin A alcohol and the natural ester of vitamin A. There was no significant difference in the blood plasma concentrations of carotene when vitamin A alcohol or the natural ester of vitamin A was fed.

P58 Soybean Oil-filled Milks for Feeding Young Dairy Calves. N. L. JACOBSON AND C. Y. CANNON, Iowa State College.

Observations were made of the growth and general health of young dairy calves fed various reconstituted milks as compared to whole milk. Five calves were placed on each experimental ration. The calves were fed at the rate of 10 lb. of milk per 100 lb. liveweight. All calves were allowed to remain with their dams for 3 days, after which time they were placed on the experimental rations for 8 weeks. Each calf received 6 g. of sulfathalidine

per day per 100 lb. liveweight for 10 days starting at birth. Daily supplements of vitamins A and D and a mineral mixture were given to all calves. All calves were muzzled and received no hay or grain.

One group of experimental animals was fed whole milk containing approximately 3 per cent butterfat. Another group was fed a reconstituted skim milk made by mixing one part of dried skim milk with nine parts of water. Five other groups were fed reconstituted skim milk plus various oils as follows: (a) butter oil, 3 per cent; (b) expeller process soybean oil, 2 per cent; (c) expeller process soybean oil, 3 per cent; (d) expeller process soybean oil, 3 per cent, plus a vitamin supplement including thiamine, riboflavin, calcium pantothenate, pyridoxine, nicotinamide, ascorbic acid, and alpha tocopherol; and (e) hydrogenated soybean oil, 3 per cent. All reconstituted milks were homogenized at 3,000 lb. pressure.

The group receiving 2 per cent soybean oil exceeded the skim milk group in growth, but calves in the soybean oil group scoured frequently. The calves receiving 3 per cent expeller soybean oil scoured badly and were very unthrifty. Three animals in this group died. Supplementation of the milk containing 3 per cent expeller soybean oil with B-complex vitamins, ascorbic acid, and alpha tocopherol neither improved the growth of the calves nor reduced the incidence of scours.

The calves in the group fed 3 per cent hydrogenated soybean oil grew well and were in excellent condition at the end of the experimntal period. There were no significant differences in growth or general appearance between the group fed butter oil and the group which received hydrogenated soybean oil. The calves of both of these groups compared favorably with those fed whole milk.

P59 Placental Transfer and Colostral Storage of Vitamin D in the Bovine.[1] H. D. Eaton, A. A. Spielman, J. K. Loosli, and K. L. Turk, Cornell University.

A study was made during the late winter feeding period and the late pasture season of the effect of a daily supplementary feeding of 100,000 I.U. of vitamin D in the form of irradiated yeast for 8 weeks prepartum on the vitamin D levels in the maternal blood plasma, newborn blood plasma and liver, and in the colostrum.

Two groups of four cows each were started on experiment in March, 1946, and two groups of four cows each in late July and August, 1946. One group at each season served as controls and the other received the daily vitamin D supplement. The groups on experiment during March and April were fed timothy hay, corn silage, and grain, and were allowed outside of the barn daily for approximately 1 hour. The groups on experiment in late July and August were on pasture except at two daily feeding periods,

[1] Supported in part by a grant from Standard Brands, Inc.

and received timothy hay, corn silage, and grain in addition to the pasture. Maternal blood samples were drawn at 8 weeks prepartum before starting vitamin D supplementation and at 2 weeks prepartum. Those calves used in determining blood plasma and liver vitamin D were sacrificed within 3 hours after birth without having received colostrum. Colostrum vitamin D was determined on a composite sample representing the first six milkings postpartum, the first milking being the next regular herd milking after parturition.

Maternal blood plasma vitamin D values, representing three cows per group, increased to a higher level in the supplemented groups than in the controls; however, the difference was not significant. The values for the late pasture season were significantly higher than for the late winter feeding season.

Newborn blood plasma and liver vitamin D values, representing three calves per group, showed no consistent differences between those calves from supplemented dams as compared to those from control dams. Both blood plasma and liver vitamin D levels were higher in the late pasture season than in the late winter period. These seasonal differences were not significant.

Colostrum vitamin D values, representing four cows per group and expressed as I.U. of vitamin D per gram of colostrum fat and I.U. of vitamin D per pound of colostrum, were significantly higher in the supplemented groups than in the controls. Total I.U. of vitamin D in the first six postpartum milkings was on the average higher in the supplemented group; however, this difference was not significant.

These data, although limited in number, suggest that the prepartal diet does influence maternal blood plasma levels of vitamin D and the colostrum content of vitamin D. Seasonal differences are apparent. The negative results in increasing the newborn blood plasma and liver vitamin D content by prepartal vitamin D supplementation are not conclusive but are indicative of the need of higher levels of vitamin D supplementation.

P60 The Effect of Protein Level on the Nitrogen Metabolism and Gains in Weight of Growing Holstein Calves. G. P. Lofgreen and J. K. Loosli, Laboratory of Animal Nutrition, Cornell University.

Two groups of purebred Holstein calves were raised to 150 lb. by a whole milk-dry starter method. From a weight of 150 to 350 lb., one group received a ration furnishing gradually decreasing amounts of protein beginning at 1.10 lb. and decreasing to 0.93 lb. of digestible crude protein per day. The second group received a ration supplying the same amounts of total digestible nutrients while the protein increased from 0.46 to 0.78 lb. per day. There was no difference in the average daily gain of the two groups of heifers, both groups gaining approximately 1.2 lb. per day for the entire

period. The average age of the calves at 350 lb. was 7.5 months, the rate of growth being approximately 70 per cent of the Morrison standard for growing Holstein heifers. The slow growth of both groups suggests that the T.D.N. allowance of the Morrison feeding standard for growth of dairy heifers may be inadequate for normal growth at these weights.

Nitrogen balances were determined on all heifers at body weight intervals of 50 lb. The heifers on the high protein level retained significantly larger amounts of nitrogen between 150 and 250 lb. than those on the lower level. This suggests a greater storage of protein in the one group even though there was no difference in gains.

Using male calves between 150 and 200 lb., nitrogen balances were determined on rations furnishing approximately 0.11, 0.27, 0.42, 0.46, 0.53, 0.64, and 1.10 lb. of digestible crude protein daily. The nitrogen retained increased as the protein in the ration increased, although the percentage of absorbed nitrogen retained was significantly less at the highest level.

Two groups of yearling heifers averaging about 600 lb. were placed on two protein levels. One group was fed an average of 1 lb. of digestible crude protein per day at the beginning and 1.2 lb. at 1,000 lb. body weight. The second group was fed the same T.D.N. level, with the protein decreasing from 0.8 lb. at the beginning to 0.61 lb. at 1,000 lb. Preliminary results on these heifers indicate that good growth might be obtained on considerably less protein than recommended by the Morrison feeding standard for these weights.

EXTENSION SECTION

Canadian Registration and Production Policies. G. E. RAITHBY, Ontario Agricultural College.

The Dairy Service Cooperative in Ohio. R. R. STARBUCK, Ohio State University.

In Ohio the Dairy Service Cooperative is organized and incorporated under the cooperative laws of the state. Fees for incorporation, membership, and services are nominal. Membership is composed of herd owners who are interested in improving their own efficiency, as well as that of their herds, through planned management.

Dairy Service Cooperatives are so organized that major producer activity in a given area (usually a county) may be more easily directed on a united front. They have proved an excellent vehicle through which common objectives may be accomplished and may serve as instruments for making intelligent adjustments when local, national, or international demands for dairy products change to lower or higher levels. Sixty-three of the eighty-eight counties in Ohio are organized on this basis.

Activity of the cooperative is directed by means of a board or central committee. Many, if not all, of the directors serve on subcommittees, which include: Production Testing (both D.H.I. and O.S. testing), Breeding, Breed Promotion and 4–H Club, Disease Eradication, Sales, and Information.

Successful operation of the Dairy Service Cooperative depends on a continuous educational program through county agent activity, vocational agriculture teachers, dairy husbandry specialists, board members, breeding technicians, and testing supervisors. Just as important, and perhaps even more important, is a cooperative membership that recognizes the need for improvement in dairy cattle and management practices.

A Method for Estimating the Yield of Pastures on Farms in D.H.I.A.

R. E. Hodgson and J. B. Shepherd, Division of Nutrition and Physiology, Bureau of Dairy Industry, Agricultural Research Administration, U. S. Department of Agriculture.

A method which is suitable for use by D.H.I.A. testers for estimating the yield of pastures on dairy farms is presented. The method is a modification of the technique reported by the Committee on Pasture Investigations Technique[1] for determining the yield of experimental pastures.

Most of the data needed for calculating the yields can be obtained from the D.H.I.A. records which the tester gets on one day in each month or testing period. The tester also must have data showing the acreage of pasture, the number of cows and heifers by age groups maintained on pasture, and the number of days in the month or testing period that each animal is on pasture. A suitable form has been developed for the use of the tester or herd owner in recording these additional data.

The yield of pasture for a given test period is calculated by figuring the total nutrient requirements of the animals maintained on pasture and by deducting from this figure the total amount of nutrients fed in the barn. The requirements of the animals are based on the average breed weights for the different age classes and on the nutrient requirements for maintenance and production as proposed by the National Research Council Subcommittee on Dairy Cattle Nutrition.[2] These requirements allow enough nutrients for the maintenance of cows 4 years old and over; for maintenance and 0.25 to 0.4 lb. growth daily for 3- to 4-year-old cows; for maintenance and 0.5 to 0.8 lb. growth daily by 2- to 3-year-old heifers; and for maintenance and 1.0 to 1.6 lb growth by 1- to 2-year-old heifers. For determining the nutrients in

[1] Preliminary report on pasture investigations technique. Joint Committee of American Society of Agronomy, American Dairy Science Association, American Society of Animal Production. Jour. Dairy Sci., 26(4): 353–369. 1943.

[2] Recommended nutrient allowances of domestic animals. III. Recommended nutrient allowances for dairy cattle. A report of the Committee on Animal Nutrition, National Research Council, August, 1945.

the supplementary feed given, grain is considered to contain 75, hay 50, and silage 18 per cent T.D.N. The difference between the total nutrients required by the herd and the nutrients consumed from supplementary feed gives the total digestible nutrients the cows obtained from pasture, which, when divided by the number of acres, shows the yield per acre for the period under consideration. Dividing this amount by 16 gives the number of standard cow-days per acre. The sum of the yield data for all periods gives the total seasonal yield of the pasture on the farm. A form suitable for making the few necessary calculations to determine the pasture yield is presented.

The authors have compared this so-called D.H.I.A. method of calculating the yield of pasture with the technical method referred to above, using an experimental pasture at the Beltsville Research Center. With the technical method, the actual liveweights and daily weights of milk production and feed consumption of individual cows were used to calculate the nutrients required for maintenance, gain or loss in weight, and milk production, and to determine the amount of nutrients provided in supplementary feed. The pasture yields as determined by the two methods are shown in the table.

Pasture yields as calculated by two different methods

Method used	Yield of total digestible nutrients in:							
	April	May	June	July	Aug.	Sept.	Oct.	Total
	(*lb.*)	(*lb.*)	(*lb.*)	(*lb.*)	(*lb.*)	(*lb.*)	(*lb.*)	(*lb.*)
D.H.I.A.	301	920	541	360	182	160	174	2,638
Technical	174	1,110	427	431	186	180	180	2,688
Ratio $\frac{\text{D.H.I.A.}}{\text{Technical}}$	1.73	0.83	1.27	0.84	0.98	0.89	0.97	0.98

There was some variation from month to month but for the season as a whole the two methods gave about the same results. Further comparisons with other experimental pastures are being made. The Extension Service of the University of Maryland is cooperating in testing this method under farm conditions in D.H.I.A. herds.

This D.H.I.A. method offers possibilities for a simple easy method of estimating the yield of dairy pastures by using data obtained with grazing animals. It is more specific and more useful than existing ways of estimating and shows effectively the variation in yield of pasture from month to month during the season.

Application of the D.H.I.A. Method of Measuring Pasture Yield. FLOYD J. ARNOLD AND R. E. SHEAFFER, University of Maryland.

During the pasture season of 1946, a Maryland D.H.I.A. supervisor, R. E. Sheaffer, made pasture yield studies on six of his members' farms. The method used in making this study was the one recommended by Hodgson and

Shepherd for use on farms in Dairy Herd Improvement Associations. Practically all of the work required to make the study was done by Mr. Sheaffer at the time of his regular monthly visit to each farm. In addition to information regularly compiled, pasture information was tabulated on two special forms. The forms were the Pasture Grazing Record and the Pasture Yield Summary.

On the six farms selected, opportunity was provided for studying different types of pastures and the result of different pasture management practices. Both interesting and valuable facts were revealed. The accompanying table shows the yield of digestible nutrients per acre by months on the six different farms.

Total digestible nutrients per acre by months

Farm	*April*	*May*	*June*	*July*	*Aug.*	*Sept.*	*Oct.*	*Nov.*	*Total*
1	655	828	485	711	594	362	447	439	4522
2	462	867	611	464	426	346	288	171	3640
3	189	869	439	441	378	352	618	.....	3286
4	328	630	255	538	295	451	168	35	2700
5	3	179	205	177	125	186	158	77	1110
6	20	98	107	179	207	157	56	63	887

The following facts concerning the pasture programs on the different farms serve to explain the difference in the yield of nutrients per acre:

Farm 1—There is no permanent pasture land on this farm. Ladino clover and orchard grass, seeded together, is used for pasture. The fields are fertilized regularly and rotational grazing is practiced.

Farm 2—Orchard grass and Ladino clover furnish about three-fourths of the total pasturage on this farm. The remaining one-fourth is permanent blue grass pasture. The pastures are fertilized but no rotational grazing is practiced.

Farm 3—About half of the time the cows on this farm are kept on permanent blue grass pasture and the rest of the time they are on orchard grass. The permanent pastures are fertilized occasionally and the orchard grass is grown in the regular rotation of crops.

Farm 4—Ladino clover and orchard grass furnish most of the pasturage on this farm. In addition there is some woodland pasture where the cows are kept when the Ladino clover and orchard grass is being rested. On the Ladino clover and orchard grass pastures approximately 300 lb. of superphosphate per acre is used annually.

Farm 5—On this farm only permanent blue grass pasture is available. No attempt has been made to increase the pasture yield by use of fertilizer, reseeding, or other pasture improvement practices.

Farm 6—Permanent blue grass pasture is the mainstay on this farm. In the middle of the summer and early fall, however, the second growth clover in the hay fields is grazed.

Selection and Repeatability of Sires Used in Artificial Insemination. RAY ALBRECTSEN, Cornell University.

The artificial insemination program in New York has progressed to the point of making it possible to get an indication of the repeatability of the proved sires used. Seven proved Holstein sires used by New York State Artificial Breeders Cooperative, Inc., have been re-proved through their daughters in artificial insemination. Each of these sires has 14 or more comparisons in his re-proving; five have maintained or increased production in artificial service as measured by their daughters' records. The data for these bulls is summarized as follows:

		Milk production (lb.)	Fat test (%)	Fat production (lb.)
7 Holstein sires, natural service	183 Daus. Av.	12,800	3.5	451
	Dams Av.	11,610	3.5	408
	Diff.	+1,190		+43
No. of daughters equal to or better than their dams		126	110	130
7 Holstein sires, artificial service	183 Daus. Av.	12,011	3.6	429
	Dams Av.	11,991	3.5	422
	Diff.	+20	+0.1	+7
No. of daughters equal to or better than their dams		98	109	96

Many factors entering into this summary need to be considered, such as: (a) Variable environment of artificial heifers (76 different herds involved); (b) higher proportion of high producing mates (400 lb. or more fat, Natural—53 per cent, Artificial—64 per cent); (c) quality of previous bulls; and (d) only records actually reported on 718 reports are used.

Of the 183 dams bred artificially to the sires, 114 had average production over 400 lb. of fat, 29 over 500, and 3 over 600 lb. The 183 artificial progeny of these seven sires made records distributed as follows: 124 over 400 lb. butterfat, 31 over 500, 9 over 600, and 1 over 700 lb.

Sires selected for use in artificial insemination as young sires and later proved offer an opportunity to evaluate selection methods under a very severe set of conditions. Five such sires, with 13 or more comparisons, have been proved exclusively through "artificial" daughters. Of these, one has been discarded on the basis of the production of his daughters, which is lower on the average than their dams. All of the bulls were selected on the basis of a herd breeding analysis; the four satisfactory bulls had daughters averaging over 400 lb. fat.

The over-all performance of all sires used by the New York Artificial Breeders Cooperative, Inc., shows the tremendous possibility of herd improvement through breeding. On cows averaging 275 lb. fat, an increase of 79 lb. of fat was obtained. Dams averaging 333 lb. fat had daughters aver-

aging 41 lb. more fat, those averaging 376 lb. had daughters showing a 44-lb. increase, and those averaging 420 lb. had daughters producing slightly less fat than did their dams. The topmost group of dams averaged 505 lb. fat; their daughters averaged 473 lb. Studies by the Bureau of Dairy Industry show that about 0.5 per cent of all sires proved could maintain or increase a 500-lb. fat level. Two bulls in this study were able to do this.

The average butterfat production per cow in New York is about 220 lb. fat. D.H.I.A. herds average around 345 lb. and the average production of the "artificial" heifers is about 415 lb. This startling difference reflects the variation in inherited ability to produce as well as the great differences in environment and opportunity afforded dairy animals.

The Montana Elevated Cow Stall in the Open Shed-milking Stable System. J. O. TRETSVEN, Montana Extension Service.

In November of 1946, the Montana Agricultural Experiment Station published a preliminary report of research work done on an elevated cow stall used in connection with the open shed-milking stable system of housing dairy cows. This stall was designed to reduce labor to a minimum, to simplify the feeding of grain, to make the milking of cows easier for the operator, to aid in the production of clean milk, and to provide for an easy and rapid exchange of cows through the milking stable. Dairy farmers who are using this type of stall report that it is highly practical. One man, with 2 single-unit milking machines in a 4-stall setup, can milk 20 to 24 cows per hour. This includes bringing the cows into the stall, feeding grain, washing udder and teats, milking, caring for the milk, and turning cows out into the shed again.

The stalls are made of pipe welded together and can be built on the farm at relatively low cost. Four stalls for the large breeds will require a stable $17' \times 17'$. With this type of stall, the milker operates between the cows coming in from the head of the stall. The stable is built on two levels to eliminate stooping while milking.

The floor, back of the stalls, and the stall floor is 32 inches above the floor between the stalls, the floor in front of the stalls, and the milkroom floor.

The stalls are only 30 inches wide for the large breeds and are slightly narrower at the head end. To keep the cows quiet when milked, the feed box is set 16 inches above the stall floor and the stanchions are placed 20 inches back from the front of the stall.

The doors for admitting and releasing the cows are operated by the milker from the trenches between the stalls.

All common makes of milking machines may be used.

The Uninsulated Pen Barn in Wisconsin. G. R. BARRETT, University of Wisconsin.

A 4-H Dairy Extension Service Program and Plan of Work. H. A. WILLMAN, Cornell University.

Problems which arise in conducting 4–H dairy work may differ widely between states and sections or even within certain states. Therefore, it often is difficult to set up a detailed program carrying with it a set of procedures or standards which may work alike everywhere.

Nevertheless, the entire National 4–H dairy program and plan of work should provide a wide choice of projects and activities. It also should include a proper balance of incentives as a further means of helping to reach, hold, and teach a greater percentage of rural boys and girls some of the fundamentals which underlie efficient dairy production.

The suggestions which follow, while not necessarily complete, are written from the standpoint of the industry and mainly as a general guide in developing state programs. The plan emphasizes the need of youth training as a major problem of the dairy industry.

PROBLEM

I. The development of future leaders, efficient dairymen, and purebred breeders.
   A. Importance of the problem.
      1. Only a very small percentage of dairy herds have been tested regularly, fed adequately, rated for type, analyzed for transmitting ability, or been headed by carefully selected sires. With the future calling for greater dairy farm efficiency, the need of changing from the old to the newer methods and working with youth becomes obvious.
      2. Boys and girls need a well-rounded experience, some income while on the farm, and an early training to prepare them for situations which they may face in later life. Competition from our industrial neighbors constantly will emphasize a need for higher yet efficient dairy production, greater acre yields, and a larger labor output per man per year. The apparent low level of human nutrition also calls for a program directed toward an improved diet of animal food products and expanded markets for these products.

II. Solution to the problem.
   A. A more active interest on the part of parents, the full cooperation of breeders, and the development of programs will help:
      1. Acquaint more boys and girls with the economic importance of dairy cattle as a source of farm income.
      2. Teach the fundamental importance of good dairy type and inheritance, the use of enough feed, proper management, adequate high yielding feed crops, and cattle health.

3. Demonstrate the use of practices which are followed by the more efficient dairymen and breeders.
4. Encourage an income ownership in cattle through 4-H club projects.
5. Encourage a wider use of animal food products in the diet for better health and expanded markets.

III. Plan of activities.

A. Sell the idea of starting more farm boys in dairy club work by using the radio, news articles, folders, posters, and by talks at schools and farm meetings.

B. Enroll boys and girls in the established 4-H projects encouraging the use of cattle which have been selected soundly on a basis of high production inheritance and acceptable type.

C. Visit or contact members at least once annually and keep in touch with county and state breed clubs and leading herd owners.

D. Organize county adult leader-breeder committees as a means of getting help in developing programs, locating suitable calves, testing herds, breeding cattle artificially, visiting project members, enlisting breed club help, and securing qualified people to teach subject matter at meetings.

E. Organize local clubs at which some special instruction may be given by such persons as successful dairymen, veterinarians, older 4-H members, extension dairymen, cow testers, technicians, and others.

F. Hold local, county, district, and state meetings, contests, and shows to stimulate interest, to recognize the achievements of members, and to encourage greater effort.

G. Assist in the development of some of the following national activities as an aid in the building of stronger county and state programs:

1. Judging.
2. Records and management.
3. Demonstrations.
4. Exhibiting, fitting and showmanship.
5. All-round achievement.
6. Cooperative effort.

THE FORTY-SECOND ANNUAL MEETING OF THE AMERICAN DAIRY SCIENCE ASSOCIATION

R. B. STOLTZ, *Secretary-Treasurer*

The American Dairy Science Association assembled in the War Memorial Hall at the Ontario Agricultural College, Guelph, Ontario, Canada, on Tuesday, June 24, at 9:30 a.m.

G. E. Raithby, local chairman, introduced President W. R. Reek, of the Ontario Agricultural College, after an organ prelude and the singing of "The King" and "America". President Reek gave the welcoming address.

Association President Fordyce Ely then was presented and gave the following address:

THE PRESIDENT'S MESSAGE

First, may I take a moment to acknowledge the remarks of President Reek, of the Ontario Agricultural College, who has so graciously welcomed us to the campus. We have been here only a short time but we feel the sincerity of the welcome which has been extended to us by members of the staff of this institution. His welcome starts this Forty-second Annual Meeting of the American Dairy Science Association in an atmosphere of good fellowship which, I am sure, will prevail throughout our sessions. There are many of us who are visiting this beautiful campus for the first time and I know that we will return to our respective institutions with a warm spot in our hearts for the Ontario Agricultural College, our gracious host on this occasion. For several months I have been very grateful for the invitation which was extended our Association to meet here, and I know that I voice the thoughts of all the members present at this meeting when I express our thanks for the many courtesies that have already been extended us as we have assembled.

It seems quite fitting and proper in these times of international intrigue and suspicion that the American Dairy Science Association should meet in Canada. I started to say foreign soil; the situation, however, offers us an opportunity to reflect for a moment on how foreign is this soil of Canada; we certainly do not feel like strangers in a strange land. We have all heard it said that the boundary between Canada and the United States is the longest in the world on which a soldier has never stood guard and across which a malicious gun has never been fired. For reasons best known to others, and which we do not need to discuss here, there has always been a freer trade in education and ideas than in goods and services between Canada and the United States. This reciprocity of thoughts and ideas, in my opinion, is a much more valuable type of free trade than any other that can

exist between people and nations. Everything worth while begins with an idea in someone's mind and when these are freely exchanged between people and nations there comes mutual respect and mutual understanding and a high degree of tolerance of each other's rights. It makes one wonder if the lack of this is one of the main things wrong with our world today, as nations suspect each other and for that reason find it impossible to be tolerant of each other's views. This meeting of the American Dairy Science Association is only another manifestation of this free exchange of thought.

During the next 3 days there will be much discussion on what is new in dairy science. The papers and reports given here, together with the private exchange of ideas between those who are interested in similar fields of work, will greatly influence the work in these fields of endeavor, not only for the coming year but for years to come.

Looking Back

Many of us will recall quite vividly a paper given by Dr. Weaver, of Michigan, before a general session of our summer meeting in 1944. I recall that he traced a parallel graph of cow numbers and milk production and a gradual increase in population in our country since 1900. Now as we think back, since 1900 this country has gone through panic and pestilence, two wars followed by peace, economic upheaval in the form of inflation and deflation, repression and suppression; now someone has said we must be prepared for repercussions. It is very significant, however, that none of these has greatly affected the important place which dairying occupies in our country's agriculture. It was pointed out, you will recall, that there exists almost a total lack of cyclic trends in cow numbers and milk production since 1900. There are more people per cow in our country today than at any previous date. On the other hand, we are told that there are about 16 years between cycles in beef cattle numbers, about 6 years between cycles in hog numbers, and a very short time, indeed, with reference to eggs and poultry. These are branches of agricultural effort that compete with cows for feed. These other branches of livestock are also more affected by economic stress and strain, but at the same time they are more adjustable on short notice than our dairy industry. This stabilizing effect of dairying on the agriculture of our nation and especially on the agriculture of a community is reflected in the people who milk cows for a living. Aside from a few of the very wealthy who pay each other high speculative prices for popularly bred cattle, dairymen are by their very nature conservative. Cows seem to appeal to the conservative minded farmers. Cows are in rhyme with conservation. This unwillingness to plunge exists as a healthy stabilizing force which affects our entire industry.

The War Taught Us a Few Things

We learned several very fundamental things during the war as everyone made the supreme effort to produce much-needed food. We learned, for

example, that high prices that were offered for milk stimulated the farmer to greater effort, but did not stimulate the cows very much. We learned that time had to pass before calves and heifers became producing cows and feed crops could be diverted into the mouths of cows. During the war period someone remarked, "Take good care of your cows; it takes longer to grow a cow than it does to build a battleship". We learned that sudden expansion of dairying was almost impossible. We accomplished about a 14 per cent increase in production over a period of 5 years. That was the best we could do in an all-out effort to produce, amounting to about 3 per cent per year under the stress of war need. When you compare this 14 per cent with the tremendous percentage of increase in other branches of agriculture that are more easily adjusted than dairying, then we realize again the stable permanence of our industry.

During the war in our quest for more food we did a little too good a job forgetting about quality, and our standards were noticeably lowered. Right or wrong we lived by the rule that poor milk was better than no milk at the time we needed it so badly. Nineteen-forty-six, following V. J. Day, was a year when everyone sought an opportunity to relax. Rest seemed to be of paramount importance following the effort put forth in producing and processing food to win the war. As we stopped to catch our breath it became more and more apparent that the one who said, "Food will win the war and write the peace", indeed predicted accurately. It was also freely predicted that Europe would need a couple of years to get back on an "eat-as-you-go" basis; we now know the error of this prediction, with more hungry nations than ever before in history. On this side of the Atlantic Ocean we have been singularly blessed with a series of bountiful crop years and we have extended this blessing to Europe in our food shipments. Someone said that for this reason the law of averages is against us for 1947, but we hope and pray that our luck will continue; 1947 looks good so far and the world should be deeply thankful.

We Are Awake in 1947

With 1947 there has come a reawakening; we have caught our breath and we are tackling many problems with renewed vigor. It would be quite out of order for me to attempt in these few minutes to discuss fully the many problems that confront our industry in 1947. I think it would be a fair statement to say that is the real purpose of our meeting. The papers and reports that will be presented are given primarily with that thought in view; I will merely make a brief mention of a few.

Renewed Efforts on Quality

Nineteen-forty-seven has brought us a renewed interest in quality standards for milk and other dairy products. With the help of members of our Association, regulatory agencies have perfected their techniques for meas-

uring quality and they are prepared to act in the interest of the public in more adequately enforcing quality standards. Nothing could be more fundamentally sound at this time than aggressive action on the part of our industry in the field of quality appreciation, both with suitable price differentials to farmers and possibly more public education through the use of consumer grades on dairy products other than milk. All branches of the food industry face this same problem, but in our dairy industry it requires a lot of effort to bring order out of a condition which may be described as being more or less chaotic. I am of the opinion that the commercial dairy interests are more serious than ever before in their desire to solve quality problems. I also doubt if there is a single member of the staff of a dairy department here who has not been called into consultation with the commercial interests where help has been sought to devise workable plans for solving local quality problems.

Farmers Help—In Sales

Farmers are learning to realize their responsibilities not only with the quality problem but in many other problems dealing with sales and surpluses. We cannot say how much will be accomplished; probably only a step in the right direction can be accomplished at a time, but the work of the American Dairy Association and their slogan of "sales not surpluses" is, of course, primarily a farmer movement with the support of the commercial dairy interests in collecting over a million dollars to support the program. This is a step in the right direction and exists as another illustration of cooperation within our industry instead of the old give and take which has too often existed between farmers and the men who buy their product.

A Shortage of Trained Personnel

Nineteen-forty-seven has brought to our industry, and especially to our college dairy staffs, personnel problems that are causing gray hairs to sprout. There have been many staff changes during 1946–47; to move seems to be the order of the day. This, with difficult housing facilities in college communities, makes the problem indeed a serious one. There has never been such a shortage of trained personnel in the field of dairying as there is today. This fact challenges members of our Association who are charged with the responsibility of training new workers and teachers. Commercial branches of our industry are also short of this same type of trained worker, and as a result they lean very heavily on members of our dairy staffs who are frequently in a position to be helpful to them in meeting emergency situations. We welcome this close tie-up with our industry if it does not require too much of the time which should be devoted to our own prescribed duties.

College and Breed Associations Are Closer Together Than Ever Before

There exists a finer, more complete working relationship between our colleges and extension staffs and the breed organizations than ever before.

This is not something that just happens, however; it is the product of a gradual, constant, and everlasting effort on the part of members of this Association through the Breed Relation Committee and the Dairy Cattle Breeding Committee, and leaders of the respective breed organizations. I am very favorably impressed with the program of the Purebred Dairy Cattle Association as planned, and with the efforts which are being made by that group to work with committees of this Association. Already much has been accomplished in standardizing testing procedures and the rules under which the artificial breeding program may be conducted.

There are found very few minor difficulties between the breeds in their classification program. The minor differences only exist in the efforts of one or more breeds to be a little more progressive as they initiate new programs. The development of the artificial breeding program is largly a product of the membership of our Dairy Science Association, coupled with the encouraging sanction of these same breed organizations through their Purebred Dairy Cattle Association. More than a million cows are now signed up by organized artificial breeding associations, and I think our dairy industry should be everlastingly grateful to E. J. Perry, of New Jersey, who was mainly responsible for initiating the program that is operating in this country at present. There has been much productive research in this field, but we still know comparatively little about the proper nutrition of bulls, and the last word has not been said or written with reference to diluters. Just a little more productive research in these fields would further advance our methods in conducting the artificial breeding work that has already experienced revolutionary changes within the short period of 9 years.

Some Movement South

With 1947 there has come a new sense of responsibility toward dairying as a source of agricultural income in the South. With the decentralization of industry which is taking place and the movement of some of this industry into the South there has come a new and greater demand for dairy products and the same for cows. There are a few advantages for dairying in the South and also in the same breath we might mention some disadvantages; I will not dwell on them. The fact remains, however, that there is a definite shift of our industry into Southern territory. Without exception leaders in ten Southern states have reported that the increase in dairying is not a temporary thing, but a permanent movement. In eight of ten Southern states development of dairying has been at the expense of "row crops" in general and cotton in particular. Dairy-mindedness seems to be the order of the day among the young people who have not had an opportunity to become so cotton-minded as some of the old timers. Money has been appropriated by Legislatures of a number of the Southern states with the definite objective of developing dairy-mindedness among the youth of their respec-

tive states. A visit to some of the 4–H Club dairy shows that have developed in the Southern states is very convincing and serves to illustrate the enthusiasm with which many Southern farmers are accepting dairying as a substantial backlog in their farming plans. Artificial breeding has just begun to reach into the Southern states; suffice it to say that these states are very serious in their intentions along lines of conservative dairy development, and I urge some of our Northern friends not to sell the South short as they consider future dairy developments in this country. Worthwhile developments in any field of endeavor do not occur over-night; the change will come gradually as fundamental difficulties are overcome.

As I end these remarks I am mindful of the many standing and special committees which have faithfully functioned during the past year. As one becomes more familiar with the workings of our Association, one is impressed with the efficiency of our faithful Secretary and the effort and thought which he puts on the affairs of our Association. The American Dairy Science Association is now a big business enterprise with total assets just short of $50,000, with a net profit for the year of nearly $5,100. Things come from or go through the Secretary-Treasurer's office with machine-like precision, and I think that we all should appreciate the value of the services which are rendered by this office. During the year Dr. F. E. Nelson, of Iowa State College, assumed the editorship of our JOURNAL. While we were struggling to find a new editor, several of us wondered if we were actually ever going to be able to find a man who would give as devoted and complete a service as our former editor, Dr. T. S. Sutton. Dr. Nelson has taken over the duties very quickly and my private opinion is that if anyone can make us forget Dr. Sutton's services, it is probably our present editor.

You will be interested and gratified, I am sure, in reports of Dr. Nelson and Professor Stoltz, your Secretary-Treasurer. Many will be very much interested in an announcement which I believe our Secretary will make of a new award to workers in the field of nutrition, closely resembling the Borden Awards. How do you like the News Letter, a product of our new editor's fertile brain?

My tenure of office during the past year has been an enjoyable experience, and I am deeply grateful to the other officers and directors, as well as the members of standing and special committees, who actually did the bulk of the work.

The Honorable George A. Drew, K.C., Premier of the Province of Ontario, was then introduced and gave a most instructive address.

Mr. Roberts Everett announced the purpose of the Dairy Industries Society International.

There were 435 members present.

GENERAL MEETING OF THE AMERICAN DAIRY SCIENCE ASSOCIATION

Guelph, Ontario, Canada, June 26, 1947

President Ely called the meeting to order at 3 p.m. in the War Memorial Building. There were 166 present.

EDITOR'S REPORT

During 1946 the twelve scheduled issues of the JOURNAL OF DAIRY SCIENCE, constituting volume XXIX, were published under the editorship of Dr. T. S. Sutton. This volume consists of 928 pages of original articles, announcements, proceedings of the annual business meeting, and indices, and 226 pages of abstracts and abstract indices. The total number of JOURNAL pages devoted to material other than advertising was 1,154.

The material published included 82 original papers (42 in the field of dairy manufacturing and 40 in the field of dairy production), 102 abstracts of papers presented at the Annual Meeting, and 447 abstracts of literature in the Abstract Section.

Between January 1, 1946, and December 31, 1946, 87 papers were received. Of these, six were rejected. The number of unpublished papers on hand at the end of the year was 25.

At the time the editorship was assumed by the present incumbent, E. G. Hastings and P. F. Sharp asked to be relieved of their duties as Associate Editors. W. E. Petersen has found it necessary to resign as Associate Editor of the Abstract Section. The editor wishes to express the appreciation of the American Dairy Science Association for the fine work of these men on behalf of the JOURNAL. E. P. Reineke and G. H. Wise have consented to act as Associate Editors of the JOURNAL and already are at work.

The editor wishes to acknowledge the fine cooperation of those people who have contributed, in many instances anonymously, to the publication of the JOURNAL OF DAIRY SCIENCE.

In April the first issue of the News Letter was prepared and mailed to all of our members and student affiliates. A second issue was mailed in June. The favorable response to this new publication moves the editor to ask for approval for continued publication.

Upon motion duly seconded the report of the Editor was approved unanimously.

SECRETARY-TREASURER'S REPORT

Membership and Circulation. The report of our membership and total circulation for the past fiscal year and the first half of 1947 excels any previous 18-month period. At the close of 1946 our total circulation was 2,877, which is over 400 higher than the highest circulation which our JOURNAL has

had since its beginning. The former peak was reached in 1941. As of June 1, 1947, our total circulation is 3,508, which is more than 1,000 higher than the previous peak of 1941. Our membership as of June 1, 1947, has reached 1,602, our subscribers 1,292, and we now have 546 student affiliates, which is 150 more than the peak in 1941. The following table gives you the total circulation as of December 31 for the past 10 years and as of June 1 this year.

Dec. 31	Members	New members	Subscribers		Associate subscribers	Student affiliates	Total
			Domestic	Foreign			
1937	928	.....	360	385	110	30	1813
1938	1101	332	352	395	125	81	2054
1939	1465	419	321	385	73	156	2400
1940	1339	105	331	360	62	283	2375
1941	1321	103	353	316	66	391	2447
1942	1276	100	371	312	49	235	2143
1943	1324	134	463	208	85	108	2188
1944	1388	111	519	233	81	45	2266
1945	1407	105	586	291	83	32	2399
1946	1583	223	677	350	85	182	2877
June 1, '47	1602	90	805	487	68	546	3508

The following data are a summary of our loss and gain in members for the year 1946:

Membership, December 31, 1945		1407
Gain: New members, 1946	228	
Former student affiliates	14	
Total gain	242	
Loss: Members resigned and delinquent for 1946:		
Delinquent	35	
Resigned	27	
Deceased	4	
Total loss	66	
Net gain in membership		176
Membership, December 31, 1946		1583

You will be interested to know that this year over 75 per cent of our members paid their dues previous to January 1.

Our circulation by states as of June 1, 1947, is as shown in the table on page 607. In computing the total circulation in this table, the new members as listed in the second column are included in the first column also and consequently are not included in the total column.

The states with the highest membership are:

First—Ohio 165	Third—New York 147	Fifth—Wisconsin 95
Second—Illinois 157	Fourth—Pennsylvania 109	Sixth—California 71

State	Members	New members	Subscribers	Associate subscribers	Student affiliates	Total
Alabama	6	1	9	.....	.....	15
Arizona	11	5	3	.....	.....	14
Arkansas	2	.....	6	1	.....	9
California	71	3	70	6	3	150
Colorado	10	.....	14	.....	1	25
Connecticut	20	3	7	.....	16	43
Delaware	2	.....	5	.....	.....	7
Dist. of Columbia	35	1	10	1	.....	46
Florida	18	4	18	.....	10	46
Georgia	21	1	13	1	34	69
Idaho	8	.....	3	.....	.....	11
Illinois	157	8	64	2	7	230
Indiana	40	.....	21	1	11	73
Iowa	37	4	6	.....	71	114
Kansas	14	3	9	.....	2	25
Kentucky	8	.....	11	2	15	36
Louisiana	14	1	12	.....	5	31
Maine	2	.....	3	1	.....	6
Maryland	38	.....	11	1	3	53
Massachusetts	37	.....	27	6	26	96
Michigan	56	1	20	4	11	91
Minnesota	59	9	15	3	8	85
Mississippi	11	1	4	.....	14	29
Missouri	43	.....	16	1	21	81
Montana	12	.....	4	.....	3	19
Nebraska	13	1	10	.....	11	34
Nevada	1	.....	1	.....	.....	2
New Hampshire	11	1	3	.....	.....	14
New Jersey	36	3	27	2	.....	65
New Mexico	3	.....	4	.....	.....	7
New York	147	5	108	8	13	276
North Carolina	17	3	8	.....	.....	25
North Dakota	4	2	3	.....	.....	7
Oklahoma	18	5	9	.....	24	51
Ohio	165	.....	48	9	58	280
Oregon	20	.....	9	.....	19	48
Pennsylvania	109	.....	44	6	31	190
Rhode Island	3	1	4	.....	2	9
South Carolina	9	.....	5	.....	11	25
South Dakota	7	1	4	.....	7	18
Tennessee	17	3	12	3	.....	32
Texas	30	.....	35	.....	27	92
Utah	9	.....	7	.....	5	21
Vermont	15	.....	5	.....	1	21
Virginia	30	.....	17	2	8	57
Washington	37	2	19	2	12	70
West Virginia	16	1	2	2	.....	20
Wisconsin	95	7	37	1	56	189
Wyoming	4	.....	3	.....	.....	7
Canada & Foreign	54	10	487	3	.....	544
Total	1602	90	1292	68	546	3508

The states with the largest number of subscribers are:

First—New York ..... 108 Third—Illinois ..... 64 Fifth—Pennsylvania ... 44
Second—California ..... 70 Fourth—Ohio ..... 48 Sixth—Wisconsin 37

The states with the largest number of student affiliates are:

First—Iowa	71	Third—Wisconsin	56	Fifth—Pennsylvania	31
Second—Ohio	58	Fourth—Georgia	34	Sixth—Texas	27

Student Branches. Certificates have been issued to Student Branches of the American Dairy Science Association at the following schools during the past year:

University of Connecticut
University of Georgia
Iowa State College
University of Kentucky
University of Massachusetts
University of Missouri
Washington State College
Cornell University
Oregon State College
Pennsylvania State College
University of Tennessee
Texas Tech. College
Virginia Polytechnic Institute
University of Florida

Back Copies. During the past year the income from the sale of back copies amounted to $2,032.46. We have not reproduced any numbers this past year. We do not have complete volumes of nos. VI, XI, or XXIX. About eleven numbers of our back copies should be reproduced when printing costs are more favorable.

Advertising. The income from advertising during the past year is the greatest income which we have ever had. The number of pages of advertising during the past year was 188, which is slightly less than last year. The income from advertising for 1946 was $7,479.43.

We are pleased to take this opportunity to again express our grateful thanks to the companies that use our JOURNAL as an advertising media. Any courtesies shown our advertisers will be greatly appreciated.

Financial. The income for 1946, amounting to $25,970.04, is the largest income during any year of our organization. Our expenses, which also excelled previous years, were $21,487.60, leaving us an operating profit of $4,483.34 as of December 31, 1946. Our net worth was $35,105.51, which is $5,097.34 higher than last year's net worth. We had an investment in government bonds of $30,799. A complete report of the Certified Public Accountant was sent to each Officer and Director on March 19, 1947.

The Secretary wishes to take this opportunity to express his gratitude and thanks to the officers and members of the organization for the splendid cooperation that they have given him.

Respectfully submitted,

R. B. STOLTZ, *Secretary-Treasurer*

Upon motion duly seconded, the report was approved.

AUDITING COMMITTEE REPORT

The President then requested the report of the Auditing Committee, which was given by Mr. W. E. Krauss.

April 7, 1947

To the Directors and Members of the
American Dairy Science Association

Gentlemen:

The Auditing Committee of the American Dairy Science Association met with Mr. Walter C. Burnham, the certified public accountant who examined the financial statement of the Secretary-Treasurer of the American Dairy Science Association. The Committee met with Mr. Burnham in Columbus on April 7, 1947.

Mr. Burnham stated that he had made a careful audit of the accounts, checked the bank statement and reconciled the checking account. He also stated that he counted the bonds held by the Association.

After conferring with Mr. Burnham, the Committee is satisfied that the statement submitted by the Secretary-Treasurer is correct. We recommend that it be accepted by the Board of Directors and the members of the American Dairy Science Association.

Respectfully submitted,

O. F. GARRETT, R. A. LARSON, W. E. KRAUSS

Upon motion duly seconded, the report of the Auditing Committee was accepted and ordered filed.

REPORT OF THE EXTENSION SECTION

The first session of the Extension Section was called to order at 1:00 p.m., June 24, by Chairman W. T. Crandall. Due to the resignation of Arthur Porter as Secretary, the Chair called for nominations to fill this office, and G. Heebink was elected. The chairman appointed Loveland, Harris, and Heebink to the Resolutions Committee and L. A. Johnson, Vergeront, and Burke to the Nominating Committee.

The report of the Dairy Records Committee was given by J. F. Kendrick and Arthur Porter. An interesting report on Canadian Registration and Production Policies was given by G. E. Raithby. R. R. Starbuck discussed Dairy Service Co-operatives in Ohio. A plan for estimating the yield of pasturage on farms was presented by R. E. Hodgson and Floyd Arnold. Fifty-nine people from 27 provinces and states registered at this session.

At the second session a film entitled "A Challenge to New York Dairymen," was shown, and exhibits presented by Ontario, New York, Iowa, Pennsylvania, Missouri, Michigan, Montana, New Hampshire, and California were examined and discussed.

The third session was held jointly with the Production Section. To avoid duplication in reporting this session, the Production Section will cover the report of the Dairy Cattle Health Committee, which was adopted.

The report of the Dairy Cattle Breeding Committee, which consisted largely of recommendations to the Purebred Dairy Cattle Association and

pertained chiefly to methods of proving sires and of approving artificial breeding organizations and inseminators, was adopted.

The Breeds Relations Committee's report, which covered recommendations in regard to uniform rules for official testing, D.H.I.A. testing, and for the proving of sires, was adopted.

The symposia on health and the national testing program, in which the Purebred Dairy Cattle Association cooperated, generated much interest and discussion.

At the session on Thursday morning Ray Albrectsen presented a paper on the Selection of Sires for Artificial Breeding Associations. Resolutions pertaining to universal pasteurization of milk and to interstate traffic in cattle infected with Bangs disease were offered and rejected. A resolution regarding thyroprotein was adopted. J. A. Nelson read a paper, prepared by J. O. Tretsven, on the Montana Elevated Cow Stall. The Uninsulated Pen Barn in Wisconsin was discussed by G. R. Barrett. Gearhart and Stallard exhibited and discussed new types of D.H.I.A. equipment.

The final session was devoted largely to a discussion of 4–H Club work, which was led by G. W. Vergeront and J. C. Nageotte.

The report of the Nominating Committee, which nominated C. W. Reaves of Florida as Secretary of the Extension Section, was adopted. The officers for the coming year are as follows: E. H. Loveland, Chairman, G. Heebink, Vice-Chairman, and C. W. Reaves, Secretary.

Respectfully submitted,

FLOYD ARNOLD, *Chairman*
E. H. LOVELAND, *Vice-Chairman*
G. HEEBINK, *Secretary*

Upon motion duly seconded, the report was accepted.

REPORT OF THE MANUFACTURING SECTION

The programs for the Manufacturing Section were held during the afternoons of Tuesday, June 24, Wednesday, June 25, and Thursday, June 26, with C. L. Hankinson as General Chairman.

Thirty-five papers were accepted for the program and only one (M6) was not presented. In addition to the regular papers, three invitational papers were given.

The business meetings of the Manufacturing Section were held Wednesday afternoon and Thursday morning.

The Committee on Reorganization and Records, with S. T. Coulter as Chairman, reported a proposed constitution and by-laws for the Manufacturing Section, which was accepted.

Article I

Name

This organization shall be known as the Manufacturing Section of the American Dairy Science Association.

Article II

Membership

Any member of the American Dairy Science Association interested in dairy manufacturing shall be eligible for membership.

Article III

Officers

Section 1. The officers of this organization shall be a chairman, a vice-chairman and a secretary.

Section 2. Election of Officers. The officers shall be elected annually at the second business meeting and shall hold office for one year or until their successors are elected. Prior to the first business meeting of the Section, the chairman shall appoint a nominating committee of three members whose duty it shall be at the time of the first meeting to place in nomination one or more members for each office. Any member shall have the privilege of placing other names in nomination for each office at either meeting. It shall be the intent of the organization that the vice-chairman succeed to the chairmanship for the following year; that the secretary succeed to the vice-chairmanship; and that the chairmanship alternate between a man from "industry" and a man from "college".

Section 3. The officers of the organization shall perform the duties generally assigned to such officers, and in addition shall constitute the program committee of the section. In order to provide a permanent file of the records of the section, the secretary at the close of his term in office shall send all section records to the Secretary of the American Dairy Science Association.

Section 4. In the absence of the chairman, the vice-chairman shall assume the duties of the chairman, and in the absence of both, the secretary shall assume the duties of the chairman.

Section 5. Committees. All committees shall be appointed by the chairman. The chairman may be directed by a majority vote of the membership present at any meeting to appoint committees, or may himself make *ad interim* committee appointments for specific duties. The duties of each committee shall be specifically provided for at the time it is appointed. Each committee shall be required to report at the annual meeting on what was accomplished and shall then be discharged of its responsibilities unless retained by a majority vote of the Section, in which case the membership shall be appointed as for new committees.

Article IV

Meetings

There shall be two business meetings each year, which shall be held in conjunction with the annual meeting of the American Dairy Science Association.

Article V

Parliamentary Authority

The rules contained in "Roberts' Rules of Order, Revised" shall govern the organization in all cases to which they are applicable and in which they are not inconsistent to these by-laws.

Article VI

Amendment to the Constitution and By-laws

The Constitution and By-laws may be amended at any regular meeting of the organization by a majority vote.

Standing committee reports were presented and accepted as follows:

(a) Committee on Milk, E. O. Herreid, Chairman (three members of his sub-committee submitted written reports).

(b) Committee on Butter, G. H. Wilster, Chairman.

(c) Committee on Products Judging, G. M. Trout, Chairman.

Motions were passed as follows:

1. That the Committees on Milk, on Butter, and on Products Judging be continued.
2. That proposal be made to the Editorial Board to reconsider the matter of publication of abstracts prior to meetings.

Two new officers elected were E. M. Barker, Vice-Chairman, and D. V. Josephson, Secretary. The officers, therefore, for the coming year are as follows: P. R. Elliker, Chairman, E. M. Barker, Vice-Chairman, and D. V. Josephson, Secretary.

Respectfully submitted,

C. L. HANKINSON, *Chairman*
P. R. ELLIKER, *Vice-Chairman*
J. M. TRIMBLE, *Secretary*

Upon motion duly seconded, the report was accepted.

REPORT OF THE PRODUCTION SECTION

The Production Section held six sessions at which some 60 papers were presented. Because of the large number of papers to be presented, it was necessary to have some of the sessions run concurrently.

In addition, one session was held in conjunction with the Extension Section. Committee reports were made by the Dairy Cattle Health Committee, the Dairy Cattle Breeding Committee, and the Breeds Relations Committee. Two symposia were held, one on "Brucellosis in Cattle" in which Dr. B. T. Simms, Chief of the Bureau of Animal Industry, discussed the various problems of the control and eradication of the disease. The subject of the second symposium was "Getting the Most Out of Our Nation-wide Testing Program". The paper prepared by G. A. Bowling entitled "The Testing Program from the Standpoint of the Purebred Dairy Cattle Associ-

ation'' was read. C. T. Conklin discussed ''Increasing the Usefulness of the Testing Program to the Dairy Cattle Breeders''. Floyd Johnston discussed ''The Responsibilities in the Testing Program''. C. W. Turner and R. W. Graham discussed ''Thyroprotein and Official Testing''.

The following reports were presented and accepted by the Production and Extension Sections in joint session.

The Report of the Dairy Cattle Health Committee covered the various aspects of dairy cattle health. The subjects of Brucellosis, Tuberculosis, Foot and Mouth Disease, Johne's Disease, Interstate Cattle Shipments, Breeding Troubles, Calf Raising, Mastitis, Greater Milk Sales, Longer Production Life, and Herd Management were considered. The report concludes ''That the Colleges and Experiment Stations remain the bulwark of research and information. The Extension Service and the Veterinary profession provide the field medium of health education distribution. Keeping abreast of the problems, finding their solutions and adequately disseminating the facts is the herd health challenge we face today and in the future.'' Resolutions on Foot and Mouth Disease and Johne's Disease were drawn for the acceptance by the general session of the Association.

The Report of the Dairy Cattle Breeding Committee was read and accepted.

A Report of the Activities of the Dairy Cattle Breeding Research Council of the Purebred Dairy Cattle Association was read by Dr. H. A. Herman. The purpose of this council is to give greater encouragement, in cooperation with experiment stations and colleges, to research in dairy cattle breeding in its broadest phases, such as production, reproduction, type, and economics of dairy farming.

The Report of the Breeds Relations Committee was read and accepted.

In addition to the preceding committee reports of the combined sections, the following reports were read and accepted by the Production Section in a separate business session.

The Committee on Resolutions of the Production Section consisted of I. W. Rupel, L. O. Gilmore, and J. H. Hilton, Chairman. Their report was read and accepted. Two resolutions were adopted for the consideration of the general session.

It was voted to consider the possibilities of publishing the paper given by Dr. B. T. Simms, on Brucellosis, in the JOURNAL OF DAIRY SCIENCE. This paper was given at the Joint Symposium of the Production and Extension Sections.

The Dairy Cattle Judging Committee Report was made by R. E. Johnson. Consideration was given to the awarding of the judging scholarships. It was voted to leave the matter to the discretion of the Awards Committee.

The Nomination Committee of the Production Section consisted of H. P. Davis, G. W. Salisbury, and J. P. LaMaster, Chairman. Nominations for

Secretary were presented. G. M. Cairns, of Maryland, was elected, making the officers for the coming year as follows: G. H. Wise, Chairman, L. A. Moore, Vice-Chairman, and G. M. Cairns, Secretary.

Respectfully submitted,
D. M. SEATH, *Chairman*
G. H. WISE, *Vice-Chairman*
L. A. MOORE, *Secretary*

Upon motion duly seconded, the report was accepted.

The minutes of the Executive Board were then read, and upon motion duly seconded, they were adopted unanimously.

NATIONAL RESEARCH COUNCIL REPORT

The most important action taken by the Division of Biology and Agriculture, National Research Council, with which the American Dairy Science Association is affiliated, concerned the establishment of an Institute of Biological Sciences. In my report a year ago I called attention to the proposed establishment of an Institute of American Biologists. During the past year progress has been made in the development of this Institute, which, by the way, has been renamed the "Institute of Biological Sciences", since the old name implied a narrower coverage of fields than the new one. The National Research Council assigned funds to assist in starting this organization and on March 18, 1947, a selected advisory committee with E. G. Butler, of Princeton University, as chairman, met in the National Research Council Building, Washington, D. C., to discuss procedure for organizing the Institute. At this meeting Dr. H. B. Steinback, of Washington University, consented to act as Temporary Executive Secretary. This committee took the following action: "This committee recommends the establishment of an organizing board for the American Institute of Biological Sciences to be made up of one representative from each of the member societies of the Division of Biology and Agriculture and to include the members of the Advisory Committee".

Dr. Griggs, chairman of the Division of Biology and Agriculture, was instructed to call a meeting of an organizing board as suggested by the Advisory Committee. It was held in the National Research Council Building, Washington, D. C., at which time a proposed constitution and budget for the first year were accepted. These, together with a statement of specific services this Institute might render its members, are attached.

Besides the usual reports of its committees, which were made to the Division of Biology and Agriculture during the year, no other action need be noted.

Respectfully submitted,
C. Y. CANNON

Upon motion duly seconded, the report was approved.

INTER-ASSOCIATION COUNCIL ON ANIMAL DISEASE AND PRODUCTION REPORT

During the past year the Council held a meeting in November at Chicago. The program, "Protecting and Promoting the Livestock Industry", was reviewed. Because of the delays encountered in obtaining approval from the member associations, the Council had been unable to activate the program. In the meantime, however, the interest created by the proposals as they were considered by the membership of the associations had served to provide wide acquaintance with the program. As a result, practically all of the proposals were being studied by appropriate committees of the Agricultural Board of the National Research Council. Consequently, the Council felt it would not be advisable to attempt to duplicate such committees and tabled the program as having accomplished the desired action.

The need for a more comprehensive study and program on Brucellosis in all its aspects is being met by the appointment of a new committee of the National Research Council.

One of the most important subjects discussed at the annual meeting was the shortage of Animal Scientists. Actually, this represents only a portion of the Nation's shortage and the Association's attention is directed to the National Research Council Reprint and Circular Series no. 127, April, 1947, on "The Shortage of Professional Workers in Agriculture and in Forestry". The estimated need for new men with Ph.D. training will total 5,080 in the decade 1946–1955. This is approximately 50 per cent larger than the number now engaged in these fields. To meet the demand, concerted action on a broad front is indicated and the Council favored the formation of an Institute of Biologists. Rarely is one association large enough to meet its own needs for public relations programs but the pooling of resources of all associations would provide for satisfactory action without undue strain upon small individual associations.

The Council recommends that the member associations continue to have symposia at their annual meetings in order that subjects of common interest to two or more associations will be discussed from the widest possible points of view.

Due to the pressure of responsibilities as head of the Agricultural Research Administration, U.S.D.A., Dr. Lambert found it necessary to resign. The American Society of Animal Production has appointed Dr. E. A. Livesay, West Virginia University, to fill Dr. Lambert's unexpired appointment.

The Council recommends that the member associations continue their financial support on the same basis as established earlier.

Respectfully submitted,
W. E. PETERSEN

Upon motion duly seconded, the report was approved.

NECROLOGY COMMITTEE

Ernest H. Brancroft, of Barre Town, Vermont, died December 17, 1945, soon after returning home from the 29th annual convention of the National Cooperative Milk Producers' Federation, of which he was a director. Dr. Brancroft was graduated from the Chicago Veterinary College in 1911. He was instrumental in the founding of the Granite City Cooperative Creamery in 1920 and was active in the dairy affairs of Vermont the remainder of his life. He was interested in politics. In 1925–26 he was a member of the Vermont House of Representatives and from 1929 to 1932 he was in the Vermont Senate. Dr. Brancroft is survived by Mrs. Brancroft, seven children, and four grandchildren.

F. W. Burns was born at Wayne, Illinois, in 1896. He went to Alabama Polytechnic Institute in 1917, where he taught for 7 years, becoming dairy specialist of the Alabama Agricultural Extension Service, which position he held until his death on April 11, 1945, following a heart attack while on a pasture tour. Professor Burns was active in state, community, and church affairs. He is survived by Mrs. Burns, a daughter, and a sister.

Forrest Clifton Button, 52, of Highland Park, New Jersey, died unexpectedly at his home, May 27, 1947, after a heart attack. He was working in his garden when he became ill. He was graduated from the College of Agriculture at Cornell University in 1916, and he received the Master's degree from Cornell University in 1932. Mr. Button was professor of dairy manufactures at the New Jersey College of Agriculture. He was interested in many civic, social, scientific, and religious organizations. During World War I he was with the U. S. Health Department. He is survived by his wife, a son, and two brothers.

Oscar Erf, 72, died at the home of his son, Dr. Lowell A. Erf, of Philadelphia, Pennsylvania, on April 28, 1947. He was a native of Monroeville, Ohio. He received his first college degree from Ohio State University in 1899. He later studied at the Von Behring Physiological Institute in Germany, and was awarded an advanced degree in 1903. Before being called to head the Department of Dairying at Ohio State University in 1907, he served in that position for a few years in the Kansas State College of Agriculture and Applied Science. He became professor emeritus in 1940 and was retired in 1945. Professor Erf was one of the founders of Alpha Zeta, a professional agricultural fraternity, and had served as Vice-President of the American Dairy Science Association.

Joseph N. Hopkins, Chief of the Dairy Products Laboratory of the State Department of Agriculture, died unexpectedly in Raleigh, North Carolina, on March 29, 1947. Immediately on release from the U. S. Army he had accepted this position. He was graduated from the Virginia Polytechnic Institute in 1932, and he was granted the degree, Master of Science, by Ohio State University in 1936. He is survived by Mrs. Hopkins, three daughters, his parents, and one sister.

Samuel D. Isaly, 47, died suddenly of a coronary occlusion in Phoenix, Arizona, on December 3, 1946. He was born in Mansfield, Ohio, and was graduated from the University of Chicago in 1920. For the past several years he was president and manager of the Isaly Dairy Company of Youngstown, Ohio, and the Secretary-Treasurer of the Isaly Dairy Company of Pittsburgh, Pennsylvania, a separate company. He also was an officer and a director of the Isaly Dairy Companies in Mansfield, Marion, and Columbus, Ohio. Mr. Isaly was active in local dairy and civic affairs as well as being interested in several national and international dairy organizations, among them being the American Dairy Science Association. He is survived by Mrs. Isaly, a daughter and son, a brother, and two sisters.

Charles D. Miller, of the Miller Ice Cream Company, Eaton Rapids, Michigan, was killed in a private airplane crash December 14, 1946.

Henry Rive, 1881–1946, was born in Jersey, Channel Islands. He was graduated from Toronto University in 1903 with B.S.A. degree, and was instructor in the Department of Dairying, Ontario Agricultural College, 1903–04. Mr. Rive was employed in commercial creamery work in the Province of Ontario from 1905 to 1909. He was appointed Dairy Instructor and Inspector in British Columbia in 1910, continuing until 1919. He saw military service in World War I. Appointed Dairy Commissioner with the Provincial Department of Agriculture, Victoria, B. C., July, 1919, he died just 2 weeks before he was due for retirement at the age of 65 years.

Respectfully submitted,

R. B. BECKER
H. S. WILLARD
E. S. GUTHRIE

Upon motion duly seconded, the report was accepted.

RESOLUTIONS COMMITTEE

Mr. W. E. Krauss, Chairman of the Resolutions Committee, submitted the following report, and upon motion duly seconded, it was adopted.

WHEREAS: The Ontario Agricultural College and the Ontario Veterinary College, through their administrative staffs and faculty, have made available to the American Dairy Science Association in this its 42nd Annual Meeting all needed physical facilities for the meeting, and

WHEREAS: Every possible personal courtesy has been given to members of the Association, and

WHEREAS: The messages of President Reek and Premier Drew at the opening session of the meeting have been exemplary of the spirit of excellent international relationships and attitudes,

Therefore, be it *Resolved:* That the American Dairy Science Association herewith officially extend its thanks and appreciation to the Ontario Agricultural College and the Ontario Veterinary College, and that the President

of this Association express this appreciation by letter to President W. R. Reek, Principal A. L. McNabb, and the Honorable George A. Drew.

WHEREAS: Because of interruption of mail service and lack of funds during and following World War II many institutions and individual workers in foreign countries have failed to receive scientific journals, experiment station and agricultural college publications, and reprints of published articles in the field of dairy science,

Therefore, be it *Resolved:* That the membership of the American Dairy Science Association be encouraged, through institution, department, concern, and individual effort, to supply such literature as the needs of institutions and individuals become known.

WHEREAS: The world food situation is still acute and probably will continue to be for some time, and

WHEREAS: Milk and products derived from it afford a sound basis around which to build satisfactory and economical diets,

Therefore, be it *Resolved:* That the American Dairy Science Association encourage greater and more efficient production of high quality milk.

WHEREAS: The Borden Company has again considered it desirable to offer their awards for outstanding research in dairy manufacturing and production,

Therefore, be it *Resolved:* That the American Dairy Science Association express to the Borden Company its sincere appreciation of this evidence of interest in research which plays such a vital rôle in the progress of the dairy industry.

WHEREAS: The American Feed Manufacturers Association has inaugurated an award to be presented by the American Dairy Science Association for the most outstanding research contribution in the field of dairy cattle nutrition,

Therefore, be it *Resolved:* That the American Dairy Science Association express to the American Feed Manufacturers Association its sincere appreciation of this evidence of interest in research which plays such a vital rôle in the progress of the dairy industry.

WHEREAS: The Purebred Dairy Cattle Association has established a Dairy Cattle Breeding Research Council for the purpose of encouraging and supporting research in the field of dairy cattle breeding in cooperation with federal and state experiment stations, and

WHEREAS: Members of the American Dairy Science Association have been asked to serve on various committees of this council,

Therefore, be it *Resolved:* That the American Dairy Science Association hereby commend the Purebred Dairy Cattle Association for this important forward-looking action.

WHEREAS: Heavy volume production of milk and its products at all times is vital to the nutritional and health requirements of all adults and

children of Canada and the United States and to the prosperity of the dairy community generally, and

WHEREAS: Healthy dairy animals are the basis of the vast dairy industries of these countries and are essential to the production and maintenance of this necessary high milk volume, and

WHEREAS: Foot and mouth disease, a dreaded livestock malady, now present in Mexico, if not finally eradicated threatens the welfare of our citizens and our dairy and livestock industries,

Therefore, be it *Resolved:* That the American Dairy Science Association hereby recognizes and points out the seriousness of this catastrophe which has befallen the livestock industries of our neighboring Republic to the South, and

Be it further *Resolved:* That the American Dairy Science Association support the action of the United States Government and its Bureau of Animal Industry actively to cooperate with Mexican livestock sanitary authorities to control and stamp out this disease.

WHEREAS: Johne's disease or paratuberculosis is a chronic, insidious disease of cattle, sheep and goats, which is on the increase in this country and is more wide-spread than is publicly known, and

WHEREAS: This disease is a potential danger to the health of herds, since dependable, practical field tests for diagnosis are unknown in spite of much fundamental research,

Therefore, be it *Resolved:* That the American Dairy Science Association go on record as favoring and encouraging further active research by the U. S. Department of Agriculture and the several states in the field of diagnostic methods which will eventually result in more accurate and more reliable tests that may be extensively applied to prevent and to control Johne's disease, which is now such a baffling problem to dairymen and veterinarians.

WHEREAS: Much of the commercial vaccine used in the program of Brucellosis control is of questionable value when used, and

WHEREAS: There is just cause for much confusion in the minds of farmers, veterinarians, and other leaders who are called upon to advise farmers in their choice of programs for the control of Brucellosis, and

WHEREAS: These conditions jeopardize the results of the program aimed at the control of this difficulty,

Therefore, be it *Resolved:* That the American Dairy Science Association go on record as recommending that the preparation, distribution, and use of vaccine to be used in the control of Brucellosis be placed under the control of the Bureau of Animal Industry of the United States Department of Agriculture.

WHEREAS: The incidence of human Brucellosis is increasing to the point where this disease constitutes a major public health problem, and

WHEREAS: The incidence of human Brucellosis is related to the incidence of bovine Brucellosis,

Therefore, be it *Resolved:* That the American Dairy Science Association recommend that universal pasteurization of the milk and cream supply would be a desirable public health measure and that the dairy industry be encouraged to take steps to bring this practice about, and

Be it further *Resolved:* That the membership of the American Dairy Science Association, through its teaching and extension activities, encourage home pasteurization of the milk and cream supply in rural homes, and in urban homes where pasteurized milk and cream are not now available.

WHEREAS: There is lack of agreement among investigators as to the desirability of widespread use for dairy cattle of thyroid extract, thyroxine, or any product producing thyroidal effects,

Therefore, be it *Resolved:* That the American Dairy Science Association recommend that further research on these products be undertaken and pursued to the point where clarity of results are obtained.

Respectfully submitted,

G. H. WILSTER, G. W. VERGERONT, J. H. HILTON,
K. L. TURK, W. E. KRAUSS, *Chairman*

REGISTRATION COMMITTEE

Mr. John Eccles, Dean of Men, made the following report for the Registration Committee. Upon motion duly seconded it was accepted.

New York	52	New Hampshire	7	Washington	2
Ohio	42	Nebraska	7	Connecticut	2
Illinois	35	West Virginia	7	Kansas	2
Wisconsin	29	Virginia	6	Wyoming	1
Pennsylvania	21	Tennessee	5	Arkansas	1
Minnesota	21	Kentucky	4	Alabama	1
Michigan	19	Quebec	4	Georgia	1
Maryland	15	California	4	Florida	1
New Jersey	14	South Dakota	4	Louisiana	1
Ontario	13	South Carolina	3	Maine	1
Vermont	12	Texas	3	Mississippi	1
Washington, D. C.	11	Rhode Island	3	Montana	1
Indiana	10	Massachusetts	3	North Dakota	1
Iowa	10	Oregon	2	Cuba	1
Missouri	9	Oklahoma	2	Nova Scotia	1
North Carolina	9	Utah	2	Manitoba	1
					407

Registration of members	407
Registration of non-members	176
Total registration	583
Women and children	328
Total attendance	911

Members from 4 provinces in Canada, 43 states in the United States, and the District of Columbia were in attendance. Non-members attended from Chile, Colombia, Hawaii, India, Holland, Sweden, and China.

Mr. Borland moved and Mr. Davis seconded that all action of the Executive Board during the past year be approved.

MEETING OF THE EXECUTIVE BOARD AMERICAN DAIRY SCIENCE ASSOCIATION

R. B. STOLTZ, *Secretary-Treasurer*

The Executive Board transacted the following business:

Approved the Editor's Report.

Approved the Minutes of the past Annual Meeting.

Approved the Secretary-Treasurer's Report.

Authorized the Secretary to purchase back copies of the JOURNAL.

Approved the report of the Auditing Committee.

Increased the budget for 1947 from $23,000 to $25,800.

Approved and prepared a budget for 1948 of $28,800.

Received the report of the representative of the National Research Council.

Placed on the table the question of affiliating with the International Dairy Federation.

Approved a plan submitted to handle student affiliates by groups rather than by individuals.

Accepted the proposal of the American Feed Manufacturers to make a $1,000 award for the best paper published on animal nutrition, and authorized the President to appoint a committee to draw up rules for handling this award.

Authorized the Secretary to issue membership receipts only to those members who request them.

Approved the action taken by the Executive Board during the past year:

1. Approval of issuing the News Letter.
2. Increasing the budget of the Secretary's clerical work.
3. Making life members of:

H. A. Harding	H. E. Ross
S. I. Bechdel	C. W. Larson

Approved the Inter-Association Council Report.

Proposals to meet in North Carolina and Georgia were discussed but postponed for later acceptance.

Rejected the recommendation to become a member of the American Institute of Biological Sciences.

Approved the Journal Management Report, which is as follows: Your Journal Management Committee desires to report as follows: Permission has been given to Squibb & Company to reproduce in their Abstract Bulletin the authors' summaries of articles in the JOURNAL OF DAIRY SCIENCE.

At the last meeting of the Association it was recommended that the possibility of making arrangements with the British Abstract Service for use of their abstracts in our JOURNAL be surveyed. The possibility has been surveyed and the plan has been found not feasible. In lieu of the inability to enlarge the abstract service in the above named manner the Committe endorsed the plans of the Editor to rearrange the procedure of handling abstracts and to broaden the coverage of journals.

The Committee endorsed also a study by the Editor of the possibility of arranging the abstracts in two columns on a slightly increased journal page to effect a saving in space.

Requests have been made that the abstracts of the papers presented at Regional Meetings of dairy science groups be published in the JOURNAL OF DAIRY SCIENCE. The Committee agreed unanimously that the request should not be granted. However, the committee recommended that the programs of these meetings be published in the News Letter.

The prompt publication of manuscripts submitted to the Editor is highly desirable. The Committee placed itself on record as favoring issuance of numbers varying in size with that of the amount of material accepted for publication, the size of issues to be left to the discretion of the Editor.

The Committee also recommends that negotiations be entered into with the International Ice Cream Association and the Milk Industry Foundation to release the Editor from the necessity of submitting the abstracts to their representatives for approval for publication.

Approved the Resolutions Committee Report.

Employed Editor for the year 1948. Employed Secretary-Treasurer for the year 1948.

Elected Honorary Member for present meeting.

Elected Paul R. Elliker to the Journal Management Committee.

Recommended the dismissal of the Committee on Quality Milk appointed last year.

The Nominating Committee consisting of A. C. Ragsdale, Chairman, J. A. Nelson, I. W. Rupel, Floyd Johnston, and H. W. Norton, nominated the following officers in April: Vice-President, R. B. Becker, of Florida, and W. E. Petersen, of Minnesota; Directors, James H. Hilton, of North Carolina; Harry A. Herman, of Missouri; Paul F. Sharp, of California; G. H. Wilster, of Oregon.

The results of the election were announced on May 31 as follows: W. E. PETERSEN, *Vice-President;* JAMES H. HILTON AND PAUL F. SHARP, *Directors.*

AMERICAN DAIRY SCIENCE ASSOCIATION ANNUAL BANQUET

Guelph, Ontario, Canada, June 26, 1947

President W. R. Reek, of Ontario Agricultural College, was toastmaster at the annual Association banquet and presented President Fordyce Ely, who installed the officers-elect as follows: Mr. Paul H. Tracy, of Illinois, was installed as President, Mr. W. E. Petersen, of Minnesota, as Vice-President, Mr. Paul F. Sharp, of California, and Mr. James H. Hilton, of North Carolina (both in absentia), as Directors.

PRESENTATION OF ASSOCIATION AWARD

The toastmaster then introduced Mr. A. C. Dahlberg, Chairman of the Association's Honors Committee. Mr. Dahlberg made the following citation:

Robert Bear Stoltz is a native son of Ohio, educated in the public schools of that state, and graduated from Ohio State University. Immediately after graduation he began his illustrious career in dairy work at Ohio State University. He was made instructor in dairying in 1912, assistant professor in 1914, and professor in 1923. In 1929 he was advanced to the chairmanship of the newly organized Department of Dairy Technology.

Few men in dairy education have had such extraordinary influence upon the dairy industries of their states. He has served as secretary-treasurer of the Ohio Swiss Cheese Association since 1918, during which time the Swiss cheese of Ohio became known for its high qualtiy. He has been secretary of the Columbus Milk Distributors Association since 1933. Through his skillful management, the bottle exchange of this organization became known throughout the nation. He was secretary-treasurer of The National Cheese Association from 1920 to 1925. In 1937 he studied the dairy industries of New Zealand and Australia. Students graduated from the Department of Dairy Technology occupy important positions throughout the dairy industry of this country. The dairy industry of Ohio recognized his leadership and worth to the industry, and recently contributed a special research fund of $100,000 to Ohio State University to be administered by him.

He has attended thirty of the thirty-five annual meetings of the American Dairy Science Association since he graduated from college. He has been honored by having four of these meetings in Columbus. In 1931 he served as Chairman of the Manufacturing Section, in 1932 and 1933 he was Vice-President, and in 1934 he was President of the Association. He assumed the responsibility of Secretary-Treasurer in 1936, and is still making an enviable record in that position. In 1936 the Association had 727 members, a paid JOURNAL circulation of 1,344, and assets of $7,939.86. The report for last year showed 1,534 members, a paid JOURNAL circulation of 2,399, and assets of $30,008.17. This excellent record is a splendid tribute to him.

ROBERT BEAR STOLTZ

It is with great pleasure that we present to Robert Bear Stoltz this certificate of Honorary Life Membership in The American Dairy Science Association.

Signed: A. C. RAGSDALE, J. A. NELSON, A. C. DAHLBERG

PRESENTATION OF BORDEN AWARDS

Mr. W. A. Wentworth, of the Borden Company, was then introduced and in turn presented the Borden Recipients during the past 10 years and their families. He then read the following statement from a brochure, which was given to each guest at the banquet: "The fact that material progress must be soundly based on scientific research is nowhere more evident than in the dairy industry. Milk is at once the most essential and the most complex of foods, backbone of a sound agriculture and a nutritious diet.

"Many of the recent advances in dairy science were pioneered by the men whose works are recorded in these pages. We believe that their accomplishments will serve as an inspiration and a challenge to others, and that the future will mirror as distinctly as the past the contributions to better living made by the members of the American Dairy Science Association."

Borden Award in Dairy Production

Mr. J. B. Fitch, Chairman of the Borden Award Committee for Production, was then introduced and made the following statement:

The Borden Award in Dairy Production for 1947 has been awarded to Joseph Clement Shaw, of the University of Maryland, College Park, Maryland. Dr. Shaw received his B.S. degree at Iowa State College in 1930, his M.S. degree from Montana State College in 1933, and his Ph.D. degree from the University of Minnesota in 1938.

Dr. Shaw has held the following positions since his graduation from Iowa State College: District Club Agent, South Dakota, 1930–32; Research Assistant, University of Minnesota, 1933–38; Associate Physiologist, University of Minnesota, 1938–40; Associate Professor Dairy Industry, University of Connecticut, 1940–45; and Professor of Dairy Husbandry, University of Maryland, since 1945. Dr. Shaw is in charge of the Dairy Production Research at the University of Maryland.

Dr. Shaw's interest and activities have been directed to dairy cattle physiology as it involves physiology of milk secretion, to herd health from the standpoint of ketosis (acetonemia), and also to various aspects of dairy cattle nutrition. His most outstanding contribution to the field of dairy production has been his basic scientific studies on ketosis in dairy cattle and he is recognized as the outstanding authority in this field of work. Through original and fundamental research he established relationships between chemical changes in the blood and the occurrence of this physiological disturbance. He was the first to study the effect of various feeding and man-

JOSEPH CLEMENT SHAW

agement practices on the production of ketosis. In addition to his valuable contributions to our knowledge of ketosis, he has added materially to our fundamental information on milk secretion.

Dr. Shaw has published 26 papers in the field of physiology. Seventeen of this number are in his own name or as senior author. He has published 16 abstracts; eleven are in his own name or as senior author.

On behalf of the Committee on the Borden Award for Dairy Production, it is a pleasure to present Dr. Shaw to receive the Award.

Mr. Wentworth then presented to Dr. Shaw a gold medal and $1,000.

Borden Award in Dairy Manufacturing

Mr. K. G. Weckel, Chairman of the Borden Award Committee for Manufacturing, was then introduced and made the following statement:

The recipient of the 1947 Borden Award in Dairy Manufacturing unanimously chosen by the Borden Award Committee from among a number of very impressive candidates is one having the benefit of broad national geographic experience. He was born in Cheney, Washington, and received his Bachelor's, Master's, and Doctor's degrees from the University of Minnesota in 1920, 1921, and 1937, respectively. His academic training was delayed by military service in the Army Air Force from 1917 to 1919, during which he served with the American Expeditionary Force. He has served as instructor and Assistant Professor at the University of Minnesota, and as Associate, and subsequently Professor, at Pennsylvania State College, where he is head of Dairy Manufactures in the Department of Dairy Husbandry. Dr. Chester Distad Dahle has been successful in, and highly regarded for, his activities in at least three very difficult fields in dairy technology: as an educator, in development research, and in industry service. It is estimated he has supervised the training of approximately a thousand 4-year students in dairy technology, 30 graduate students, and over 2,000 joint industry-college short course students.

In the realm of dairy research, he has studied and published material on a wide range of manufacturing problems. Dr. Dahle has been a pioneer in the study of the behavior of ice cream mixes upon aging; of the manufacture of concentrated ice cream mix; of the high-short pasteurization of ice cream mix; of the "bound-water" of dairy products; of the electro-kinetic velocity of fat globules, and its relation to certain dairy phenomena; of the development of oxidized flavor in fruit ice creams due to metallic effects; and of the nature and effects of removal of fat globule membrane on properties such as the churning, freezing, and thawing characteristics of cream and the whipping ability of ice cream mixes. He has contributed much from his studies on the properties and effects of the several forms of ingredients in ice cream, the homogenization of ice cream mix concerning which he developed a now widely-used homogenizer valve, the production of Cheddar and

CHESTER DISTAD DAHLE

of grating type hard cheese, the production and characteristics of plastic frozen cream, and the properties and uses of dry skim and whole milk. It should not be overlooked that the State of Pennsylvania, from which he hails, is the Nation's largest producer of ice cream.

In addition to his research, Dr. Dahle has been active in the affairs of the Association as a Chairman of the Manufacturing Section, and currently as an Abstract Editor for the JOURNAL OF DAIRY SCIENCE. As Chairman of the Statistical Research Committee of the International Association of Ice Cream Manufacturers, as a regular contributor to the industries trade publications, and as a conductor of successful industry short course conferences, he has ably translated science to the useful benefit of the manufacturing industry.

I have the pleasure to present, on behalf of the American Dairy Science Association, Dr. Chester Dahle, to receive the Borden Award in Dairy Manufacturing.

Mr. Wentworth then presented to Dr. Dahle a gold medal and $1,000.

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ABSTRACTS OF LITERATURE

F. E. NELSON, Editor
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PUBLICATIONS AND ABSTRACTS

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JOURNALS

American Butter Review
American Milk Review
American Journal of Diseases of Children
American Journal of Physiology
American Journal of Public Health
Archives of Pediatrics
Australian Journal of the Council for Scientific and Industrial Research

Biochemical Journal

Canadian Dairy and Ice Cream Journal
Canadian Journal of Public Health
Canadian Journal of Research
Certified Milk
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Journal of American Medical Association
Journal of the American Oil Chemists Society
Journal of American Veterinary Medical Association
Journal of Animal Science
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Journal of Nutrition
Journal of Pathology and Bacteriology
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Milk Dealer
Milk Industry
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National Butter and Cheese Journal
New Zealand Journal of Science and Technology

Nordisk Mejeri-Tidsskrift

Pacific Dairy Review
Proceedings of Society of Experimental Biology and Medicine

Refrigerating Engineering

Scientific Agriculture
Southern Dairy Products Journal

SPECIAL PUBLICATIONS

Federal Dairying and Bacteriological Establishment, Liebefeld, Berne, Switzerland

International Association of Ice Cream Manufacturers
Milk Industry Foundation

National Institute for Research in Dairying, Reading, England
New York Association of Dairy and Milk Inspectors

Prussian Dairy Research Institute, Kiel, Germany

State Agricultural Colleges and Experiment Stations

The Royal Technical College, Copenhagen, Denmark

United States Department of Agriculture

ABSTRACTS OF LITERATURE

BACTERIOLOGY

244. Fundamental Aspects of the Thermoduric Problem. W. A. CORDES, Sealtest, Inc., N. Y., N. Y. Milk Indus. Found. Assoc. Bul., *39*, 8: 195–208. Feb. 21, 1947.

Thermophilic bacteria are largely an in-plant problem, frequently resulting from old returned milk. On the other hand, the thermoduric problem is related to farm sanitation. Over a 5-month period the laboratory-pasteurized count of a plant receiving from 66 dairies was 28,360 per ml. Fifty machine-milking dairies averaged 31,000 pasteurized count and the 16 hand-milking dairies averaged 1,550 per ml. No hand-milking dairy had a high pasteurized milk count, which pointed to the milking machine as a cause of the trouble.

Milk stone from machine-washed cans was found to have a pasteurized plate count of zero. However, inflations and milk tubes showed a pasteurized count as high as 1,500,000 per ml. when rinsed with 50 ml. of sterile water; 0.1 g. of milk stone from a can in 5 ml. of sterile water gave 1,080,000 per ml. Pulsators and air lines also required attention. Many causes of poor cleaning and sterilizing results were found, but either dry or wet storage gave good results if used properly. For dry storage a final clean water rinse of at least 180° F. is required. A final 4-month period showed an average pasteurized count of 4,400, or less than one-sixth that of the initial 5 months. The value of a thermoduric program lies in the detection and elimination of dirty milking machines and insanitary practices of cleaning and handling. E.F.G.

CHEESE

245. Streamlined Cheese Making. W. FOUST, Belle Center Creamery and Cheese Co., Belle Center, Ohio. Natl. Butter and Cheese Jour., *38*, 5: 40. May, 1947.

A center-slung centrifuge is used to remove the whey from the curd at the time of dipping Cheddar cheese. The curd is left in the spinning centrifuge until it is ready for milling. Then it is cut into slabs, removed from the centrifuge, and run through the mill. The procedure saves space and labor; the vat can be used again for another batch of milk while the curd is spinning. An acidity of 0.25% can be developed safely in the whey before dipping; when this is done the curd can be removed from the centrifuge and milled after 10 min. and can be salted 20 min. later. The finished cheese is closer in texture, better in flavor, and lower in moisture than that produced by the

conventional method. The method may lead to other mechanical improvements in handling curd. W.V.P.

CHEMISTRY

246. Monthly Variations in the Composition of Milk. O. R. OVERMAN, Univ. of Illinois, Urbana. Milk Indus. Found. Assoc. Bul., *39,* 8: 217–224. Feb. 21, 1947.

Results presented in Ill. Agr. Expt. Sta. Bul. 325 and Bul. 457 are discussed. Based on the analysis of 2,426 milk samples, monthly average values are given for Ayrshire, Brown Swiss, Guernsey, Holstein, and Jersey breeds for fat, protein, lactose, ash, total solids, solids-not-fat, and specific gravity. The percentage values for all components except lactose tend to be highest during the colder months. For lactose the tendency is toward higher values during the warmer months. E.F.G.

DISEASES

247. Raising Heifer Calves on Mastitis Milk. S. D. JOHNSON. Amer. Vet. Med. Assoc. Jour., *110,* 840: 179–182. March, 1947.

A preliminary report on the effects of raising heifers on mastitis milk tends to indicate that no pronounced detriment results. Of 12 heifers penned separately and pail-fed from infected udders, none showed *Streptococcus agalactae* at freshening, but 10 quarters were permanently infected with hemolytic staphylococci. Six heifers, penned together and pail-fed milk from infected udders, calved with only one positive reaction for *agalactae.* A large number of Guernsey calves were raised on nurse cows that were infected with mastitis. Examination of nine of the cows that had freshened and 15 that were near freshening showed no especially harmful results. T.M.L.

248. Vaccination against Brucellosis. C. M. HARING, J. TRAUM, AND W. E. MADERIOUS. Amer. Vet. Med. Assoc. Jour., *110,* 839: 103–107. Feb., 1947.

Although strain 19 of the *Brucella abortus* organism has been shown to be of definite value as an aid in the control of Bang's, the resistance to this strain by vaccination may be overcome by exposure to wholesale (massive) field infections. Vaccination with strain 19 has certain limitations in that it is a suspension of live organisms in physiologic saline solution and is a fragile product subject to rapid deterioration. The vaccination of heifers at ages approaching and subsequent to sexual maturity is relatively efficient. Vaccination of heifers at ages older than those commonly recommended gives satisfactory results.

It is recommended that negative adult cows be vaccinated to prevent sudden acute outbreaks of abortion. The practice of revaccination of adult

animals, previously vaccinated as heifers, appears to be promising. There is considerable room for improvement in method and vaccine for Bang's.

T.M.L.

249. Vaccination Studies on Bovine Trichomoniasis. B. B. MORGAN. Amer. Jour. Vet. Res., *7*, 26: 54–56. Jan., 1947.

To determine the efficiency of immunizing cows against *Trichomonas foetus* by intramuscular or intravenous injection of motile trichomonads, 30 virgin heifers, all about 12 months of age, were divided into three groups of ten each and injected with various concentrations of trichomonads. Thirty virgin heifers not injected with trichomonads served as controls.

Group A received 16 biweekly injections with concentrations increasing from 5 to 50 million organisms. Nine of these ten heifers calved normally. Trichomonads were isolated from all of the control group, but from only one of the experimental animals. In Group B the heifers were injected biweekly for 3 weeks with 5 cc. of a concentration of 50 million organisms per cc. Only three of these animals became pregnant and seven were heavily infected with trichomonads. The control group had four negative and six positive animals. Group C received only two injections over a 3-week period and eight of the ten heifers were heavily infected and none became pregnant.

Temporary immunity may result after a long series of injections, but the vaccination of heifers is ineffective for protecting breeding females and cannot be recommended as a practical procedure. T.M.L.

250. Clinical Use of Sulfamerazine in the Treatment of Hemorrhagic Septicemia and Pneumonia in Cattle. J. L. MCAULIFF, Amer. Vet. Med. Assoc. Jour., *110*, 842: 314–317. May, 1947.

An initial daily dose of 1.5 g. of sulfamerazine per lb. of body weight, administered in equal parts at 8-hr. intervals and followed by a dosage of 0.5 g. per lb. for 2 or 3 days thereafter, has proved very successful in relieving clinical symptoms of pneumonia and hemorrhagic septicemia. The drug had no apparent toxic effects. T.M.L.

251. Muscular Dystrophy (White Muscle Disease) in Young Calves. L. R. VAWTER AND E. RECORDS. Amer. Vet. Med. Assoc. Jour., *110*, 840: 152–157. March, 1947.

A condition similar to "white muscle disease" or "stiff lamb disease", found extensively in young lambs under 1 month of age, has been observed in young beef calves. The disease was observed in calves of western beef herds wintered on poor-quality range hay. The largest number of cases occur in late winter and early spring; as soon as the cows are turned to pasture or given a supplement of good alfalfa hay, the incidence subsides almost immediately.

The condition usually occurs while the calves still are nursing (from 10 days to 2 months). Frequent bawling, inability to nurse, slightly stiff joints, and occasional small lesions on the tongue characterize the first observable symptoms. Skeletal and cardiac muscles are affected greatly, as determined by post mortems. Clinical observations at autopsy usually reveal skeletal muscle lesions or localized cardiac lesions. The malady occurs in two forms, the peracute and subacute. Fever seldom is recorded until paralysis or prostration occurs.

The symptoms and anatomical lesions observed in the calves closely resemble those found in spontaneous muscular dystrophy in young lambs and those induced in lambs, rats, rabbits, guinea pigs, and some birds by diets deficient in vitamin E. Although nutritional deficiency would seem a likely explanation of the disease, no positive conclusions have been drawn.

T.M.L.

FEEDS AND FEEDING

252. The Prophylactic Administration of Vitamins to Dairy Calves. L. O. Gilmore, L. M. Jones, L. A. Kanegis, and M. H. Roepke. Amer. Vet. Med. Assoc. Jour., *110*, 843: 390–392. June, 1947.

Data from 159 unselected calves, born over a period of 3 years and representing 76 control and 83 experimental animals, indicate that the administration of vitamins (A, B, D) to young calves during their first month of life apparently is of no measurable benefit. The criteria for comparison of control and experimental groups were incidences of scours and pneumonia, gain in body weight, and apparent thriftiness. T.M.L.

ICE CREAM

253. Packaged Ice Cream. H. B. Grant. Ice Cream Field, *49*, 3: 10. March, 1947.

A recent survey indicates that one-third of the total volume of ice cream now goes into packages, whereas prior to the war it fluctuated somewhat below 20%. Of those polled, 82% listed the grocery store as the best outlet for their products, 64% reported satisfactory sales in drugstores, and 50% used frozen food stores as regular outlets. Only 7% listed department stores as outlets.

Seventy-five per cent indicated the need for redesigning their packages for better eye appeal. The tray-pack seemed to be the style package favored most, with 56% preferring it and 28% favoring the pail style container. Considerable divergence of opinion was expressed regarding the advisability of selling 6-cent, 7-cent, and 10-cent cones, cups, or novelties; 46% favored 10-cent items and 89% agreed that the "kids' nickel" still will buy something. W.C.C.

254. Production—Back on the Ice Cream Standard? E. L. KOEPENICK, Natl. Conference of Ice Cream Industries. Ice Cream Field, *49*, 2: 20. Feb., 1947.

Definitions and standards for ice cream, frozen custard, sherbet, and water ices are proposed. These are offered as suggestive of the type of definitions and standards which may be adopted for these and other foods. W.C.C.

255. Freezing Cream for the Ice Cream Manufacturer. G. M. TROUT, Michigan Agricultural Expt. Sta. Food Freezing, *2*, 4: 203. Feb., 1947.

The two possible major defects to be overcome if frozen cream is to meet the demands of the ice cream manufacturer are "oiling off" upon defrosting and oxidized flavor. The only control of the "oiling off" factor is the use of 10–12% sugar in the cream to be frozen for subsequent use in ice cream mix. Avoidance of oxidized flavor is accomplished by the following: (1) Obtain cream only from high quality milk. (2) Handle milk and cream out of contact with copper. (3) Store only low-acid cream. (4) Store a cream testing 50% fat. (5) Pasteurize the cream at a high temperature to destroy pathogenic bacteria and reduce the numbers of non-pathogens, to inactivate the enzymes, particularly lipase, and to produce reducing substances (sulfhydryl compounds responsible for the cooked flavor) in the cream. A minimum pasteurization temperature of 165° F. for 15 min. is recommended for cream to be frozen for prolonged storage; a definite cooked taste must be developed. (6) Avoid air incorporation in the cream. (7) Package and store cream in non-absorbent, impregnated paper containers. (8) Sample the cream before freezing, code the containers, and taste the cream at various intervals of storage. L.M.D.

256. Bananas—North of the Border. P. R. FOOTE, The Standard Fruit Products Co., Cincinnati, Ohio. Ice Cream Field, *49*, 2: 40. Feb., 1947.

Bananas of the highest quality are obtained when the fruit is allowed to ripen in the sun. Processing properly ripened "Lady Finger" or Chinese variety bananas as puree in modern sanitary plants in the heart of Cuba results in a product that serves as a good source of flavor for ice cream. Since this product was introduced to the ice cream industry in the United States slightly over a year ago, thousands of loads have been distributed. Imports are stabilized on a year-around basis. W.C.C.

257. Effect of Freezing Storage on Strawberries, Blackberries, Raspberries, and Peaches. J. G. WOODROOF AND ETHYL SHELOR, Georgia

Experiment Station and TVA, cooperating. Food Freezing, *2*, 4: 206. Feb., 1947.

Strawberries, blackberries, raspberries, and peaches were frozen and stored at – 10°, – 20 to 0°, 0 to 10°, and 10° F. for 1 year. Examinations were made after 3, 6, 9, and 12 months. Records were made of appearance, color, aroma, flavor, texture, leakage, and resistance to crushing.

Desirable appearance, color, aroma, texture, and flavor of strawberries were preserved much better at – 10° F. than at higher temperatures or at fluctuating temperatures. Strawberries were in better condition after 12 months' storage at – 10° F. than after 6 months at 10° F. All of the fruits deteriorated more rapidly at a temperature fluctuating from 0 to 10° F. than when held constant at 10° F.

Blackberries and raspberries stored at – 10° F. were superior to those stored at higher temperatures, but the differences were not so great as those found with strawberries and peaches. All samples of frozen blackberries and raspberries developed a semi-cooked aroma and flavor; blackberries had a semi-cooked color. Peaches deteriorated more rapidly in flavor and color than did the other fruits at the four temperatures indicated. They also seemed to lose quality more rapidly at fluctuating temperatures than did the other fruits.

In these experiments sugar or sirup was not used in order that firmness could be determined with a tenderometer. Antioxidant was not used with the peaches in order that natural color retention could be observed at the various storage temperatures through the 12-month period of observation.

L.M.D.

258. The Effect of Various Pretreatments of Frozen Peaches on Quality. Lenore E. Sater, Mary E. Kirkpatrick, Kay E. Stein, Hazel B. Murray, and Dorothy G. Skinner, Bureau of Human Nutrition and Home Economics, Agr. Research Admin., U. S. Dept. of Agr. Food Freezing, *2*, 3: 128–131, 144. Jan., 1947.

The color, flavor, texture, ascorbic acid content, and enzyme activity of peaches frozen and stored under home conditions were studied to determine the effects of various treatments and packs. Treatments to prevent browning consisted of dipping for 1 min. in citric acid, Frulite, and sodium bisulfite and then packing in 40% sirup or a 3:1 ratio of fruit to dry sugar, using Golden Jubilee and Elberta varieties. September Elberta peaches were packed in 40 and in 60% sirup containing various amounts of ascorbic acid. Analyses for palatability, enzyme activity, and ascorbic acid content were made on the fresh and freshly-frozen peaches, and at the end of 4, 8, and 12 months of storage.

Dipping in a 0.75% sodium bisulfite solution before packing resulted in a very objectionable flavor and a bleached color. Although all of the other

four treatments were satisfactory, peaches packaged in ascorbic acid-sucrose sirup and those dipped in Frulite before packaging were the most successful. Regardless of treatment, all the 40% sirup-packed peaches were superior to the corresponding dry sugar packs in all respects.

(Abstractor's note: At the present time the Food and Drug Administration does not permit the addition of Frulite (Thiourea) to commercial foods because its safety has not been demonstrated clearly.) L.M.D.

MILK

259. The Relationship between Atmospheric Temperature and the Frequency of Low-grade Milk Samples in Devon. H. H. MITCHELL. Dairy Indus., *12*, 4: 351–352. April, 1947.

A 3-year study involving the milk from about 8,000 producers demonstrated conclusively that a close relationship exists between atmospheric temperature and the quality of the milk received. When the prevailing temperatures were 45° F. or less, the amount of Grade C milk received was below 5%. During summer months when mean temperatures were between 60 and 65° F., the amount of inferior grade milk approached 20 to 30%. A graphic chart covering the 3-year study is presented. D.V.J.

260. Planning an Efficient Receiving Room. V. SCHWARZKOPF, Lathrop-Paulson Co., Chicago, Ill. Milk Dealer, *36*, 5: 48. Feb., 1947.

Some of the important considerations in planning the receiving room and in selecting the proper equipment for highest efficiency under a given set of conditions are: (1) Volume of milk to be received per hour, (2) number and size of cans to be received per hour, (3) number of producers and their average daily delivery of milk, (4) accessibility of the room for getting cans in and out, (5) relative elevation of driveway and receiving room floor, and (6) relative location of receiving room to driveway or street. Arrangement and equipment, the conveyor system, dumping and weighing of milk, the can washer, and ventilation are discussed. C.J.B.

261. Pasteurization of Milk. Current Comment. Amer. Med. Assoc. Jour., *133*, 4: 249. Jan. 25, 1947.

This editorial encourages compulsory pasteurization of milk and decries irresponsible persons who do not recognize the advantages of the pasteurized product. D.P.G.

262. Quality Control in Dairy Plants. E. S. GUTHRIE, Dept. of Dairy Indus., Cornell Univ., Ithaca, N. Y. Milk Dealer, *36*, 5: 144–149. Feb., 1947.

The effects of dairy utensils, feeds, lipase, copper, and sunlight on the quality of milk are discussed. The author recommends the use of hot water

for sterilizing utensils, preventing feed flavors by feeding silage and other highly flavored feeds immediately after milking, preventing the development of a rancid flavor by heat treating the milk, and preventing oxidized flavors by eliminating copper in the equipment that comes in contact with milk and avoiding the exposure of the milk to light. Improving the keeping quality of milk by deaeration and preventing the development of oxidized flavors by destroying the vitamin C also are discussed. C.J.B.

263. Relations of Metals to Milk. F. R. PATTISON. Dairy Indus., *12*, 4: 329. April, 1947.

The corrosion of the various types of metals used in dairy equipment and utensils is discussed. The effect of protective films set up on the surface of nickel, by hot milk, is pointed out. This effect is specific for hot milk on nickel and does not hold for other fluids or other metals. The influences of temperature, oxygen content, rate of flow and acidity of milk are discussed, as well as the possibility of galvanic effects with certain metals. Aluminum is highly resistant to corrosion by milk, but its inferior mechanical properties and low resistance to brine and alkali limit its use in dairy equipment. High nickel alloys are emphasized; their resistance to corrosion, their strength, thermal conductivity, and adaptability to fabrication make them very suitable for dairy equipment. D.V.J.

264. Streamlining Plant Operations, Distribution. R. W. BLACKBURN, Safeway Stores, Inc., Los Angeles, Calif. Milk Dealer, *36*, 5: 152–155. Feb., 1947.

Methods used by Safeway in streamlining its milk operations are discussed. Storage tanks are used in place of milk cans on the farm and for transporting the milk to the plant. This streamlining is more economical; tank hauling resulted in a saving of 0.054 cents per gallon or 6.27 cents per 100 lb. of milk. Time and labor at the producing dairy are saved; approximately 15 min. a day is required to wash and sterilize the storage tank as against 3 hr. a day for cans. The weighing (measuring) and sampling of the milk are more accurate and the quality of the milk is improved. The advantages of using paper containers and of selling milk through stores are discussed. C.J.B.

265. Cost Reduction in the Bottled Milk Industry. C. H. ZAMZOW, JR., George Fry and Associates, Chicago and New York. Milk Dealer, *36*, 5: 45. Feb., 1947.

One of the most urgent problems confronting milk dealers today is to increase productivity while reducing costs. The part that complete production engineering programs can play in solving these problems is discussed

under the following headings: (1) What is production engineering? (2) Results to be expected from a program. (3) Production engineering department. (4) Developing the program. (5) Training the production engineering department personnel. (6) Gathering basic data upon which to base the program. (7) Familiarize management and labor with production engineering. (8) Work simplification and methods analysis. (9) Job evaluation. (10) Establishment of production standards. (11) The establishment of production schedules. (12) Installation of a wage incentive plan. (13) Cost control, maintenance, and follow-up. In the final analysis, the goal of every business is a better product manufactured at the lowest possible cost in order that competition in the consumers' market may be met successfully. A production engineering program properly applied and maintained is the direct road to that goal. C.J.B.

266. Experiments in Changing Food Habits. MARIAN RADKE AND DAYNA KLISURICH, Child Welfare Research Sta., State Univ. of Iowa, Iowa City. Amer. Dietet. Assoc. Jour., *23*, 5: 403. May, 1947.

The group decision method was found superior to the lecture method in increasing consumption of bottled milk and evaporated milk in a series of experiments on changing food habits.

In the group decision method, groups of six to nine women met together and a group leader gave information about the nutritive value of milk and ways to increase its consumption by the family. Discussion of the subject and a decision by the group to increase the milk consumption of their families followed. Four weeks following the meeting, 50% of the women had increased their families' consumption of bottled milk and 50% had increased their families' consumption of evaporated milk as compared to corresponding percentages of 14 and 33 in the groups to whom a lecture on the nutritive value of milk was given.

Similarly, when the group decision method was compared with individual instruction in determining whether mothers followed recommendations regarding the use of cod-liver oil and orange juice in feeding their newborn infants, the group decision method was found superior in producing the desired response. M.B.

267. Chocolate Milk. R. A. SIMONET, Robert A. Johnston Co., Milwaukee, Wis. Milk Dealer, *36*, 5: 150, 151. Feb., 1947.

The manufacture of chocolate milk is discussed. Some of the causes of unsatisfactory results are: (1) too much milk; (2) too little powder or sirup; (3) too low holding temperature at pasteurizer; (4) insufficient cooling at surface cooler; (5) vat cooling; (6) lack of proper agitation while batch is hot at pasteurizer; (7) excessive agitation of finished (cooled) chocolate

drink; (8) breakdown at bottler or washer, allowing last few gallons in pasteurizer to stand without agitation and paddles not long enough for proper agitation; (9) running hot batch from pasteurizer over surface cooler more than once; (10) allowing finished bottles of chocolate drink to remain too long at room temperature; (11) small hand-operated batch when 10 or 20 gallons of chocolate milk are held in receptacle above small surface cooler without agitation; (12) lack of proper increase of holding temperature for excessive pipes, elbows, and homogenizers; (13) improper storage of flavoring; (14) lack of rotation of chocolate flavoring in stock room; and (15) pumping finished cold chocolate milk without additional heat to compensate for agitation in the cold pump.

Jelling usually is caused by too little milk, too much flavoring, too much heat at pasteurizer above standard set, or insufficient agitation at pasteurizer. Jell once formed in the bottle can be broken by agitating the bottle or shaking the pile of milk crates in storage; jell does not return. Settling cannot be corrected in the finished bottle. C.J.B.

SANITATION AND CLEANING

268. Cleansing of Dairy Utensils. I. The Bacterial Content of Utensils Sterilized by Approved Methods. S. B. THOMAS AND ELEANOR JONES-EVANS. Dairy Indus., *12*, 4: 347. April, 1947.

The efficiency of three types of farm sterilizers was investigated. Utensils were checked for sterility by rinse and swab techniques, using yeastrel milk agar for colony counts.

All sterilizing units were found to be satisfactory; the steam produced by each apparently provided efficient sterilization. Thermoduric counts were 3,500 per utensil for sterilized equipment and 133,000 for washed (warm water) utensils. The importance of removing milky residues from utensils before sterilizing is pointed out. Frequent or periodic servicing of sterilizing units is recommended. D.V.J.

269. Bacteriological Aspects of Can Washing. C. A. SCARLETT. Dairy Indus., *12*, 5: 430–434. May, 1947.

Cleaning and sanitizing of milk cans are discussed under the headings of washing, sterilizing, and drying. Both mechanical and hand cleaning procedures are considered. The removal of all organic matter is emphasized and the relative merits of chemical and steam sterilization are discussed. Steam sterilization is more satisfactory because of its penetrating power and drying action. If the bacteria count per ml. of capacity of the can (rinse count) does not exceed that of the milk, there is little danger of serious deterioration of milk placed in the can. Clean dry cans will remain in a satisfactory condition for 2 days after cleaning and sterilizing. D.V.J.

270. **Washing and Sterilizing of Milk Bottles.** W. A. JOSEPHSON, Sheffield Farms Co., Inc., N. Y. C. Milk Indus. Found. Assoc. Bul., *39*, 8: 209–216. Feb. 21, 1947.

Investigations revealed that all sizes of bottles consistently met operating standards for bacterial counts when they emerged from the final caustic soak, providing proper caustic strengths and temperatures were maintained. However, bottles have been recontaminated and high bottle counts have resulted from contaminated rinse water, improper chlorination, improper type and adjustment of chlorine jets, and faulty sample collection technique. Drawings illustrate how changes in four types of bottle washers resulted in improvements. Detailed directions are given for taking washed bottle samples. E.F.G.

271. **A New Approach to the Bottle Washing Problem.** J. C. L. RESUGGAN AND J. G. DAVIS. Dairy Indus., *12*, 5: 443–454. May, 1947.

A new non-foaming tetra-alkyl ammonium compound, di-n-octyldimethylammoniumbromide, has been developed in England. This cationic wetting agent has strong bactericidal powers. Comparisons were made between it and another common cationic agent producing foam and between it and well-known alkaline powder detergents. The greater efficiency of the cleaner containing the new cationic agent suggests that the use of non-foaming quaternary ammonium compounds may be an advance in the cleaning of milk bottles. Work is continuing. D.V.J.

MISCELLANEOUS

272. **Principles of Refrigeration Applied to Storage Space.** P. B. CHRISTENSEN, Merchants Refrigerating Co. Food Freezing, *2*, 3: 135–137. Jan., 1947.

Explanations of relative humidity, moisture vapor pressure, and dew point and their importance in connection with refrigerated spaces are given. Charts illustrate the drying power of air at low temperatures with fixed humidity and varying temperatures or at varying humidities and temperatures. Relationships of these factors to insulation are emphasized. Vapor seals must be used on both sides of cooler insulation where outside temperatures go below the inside cooler temperature; in the case of freezers, only a warm side vapor seal is needed. L.M.D.

273. **Industrial Wastes—Dairy Industry.** H. A. TREBLER AND H. G. HARDING, Natl. Dairy Research Lab., Inc., Baltimore, Md. Indus. Engin. Chem., Indus. Ed., *39*, 5: 608–613. 1947.

Dairy products are highly concentrated and perishable, and their wastes have a high pollution value. The trend is toward large manufacturing

plants equipped to utilize all by-products. Although the large plants help to utilize waste from near-by small plants, waste disposal still is a serious problem in many scattered small plants.

The dairy industry has several kinds of waste which often may be treated separately. General domestic waste from lavatories, locker rooms, and laundries should go to septic tanks or city sewers. Boiler blow-off, which is alkaline and hot, is beneficial to septic and digester tanks and may be discharged into them. Backwash and regeneration rinse waters and cooling waters generally should be segregated and sent to storm sewers or into streams. Care must be taken in the disposition of spoiled products. Sometimes the most practical method is to truck them out for dumping in some isolated spot. By-product wastes, such as whey, buttermilk, and excess skim milk, are the worst offenders in stream pollution. These wastes should not be dumped into clean streams or small city sewers; they are not handled economically in either city or private industrial sewage disposal plants. Improved by-product utilizations should gradually decrease the waste from this source.

Waste from drips and leaks should not occur, but if present they sometimes may be recovered for animal food. Wash waters may require some kind of treatment before they are discharged into small streams. A reliable method for flow measurement and sampling should be provided; an automatic sampler is described. An aerated flow equalizing tank, which will distribute the load and provide some biochemical oxidation, is needed when dairy waste is to be discharged into a stream or into a small city disposal plant. The necessary treatment for waste should be given, if possible, in combination with existing or future city waste disposal plants. If these means are not available, the trend is toward treatment or recirculating trickle filters. Efficient and economical control, maintenance, and supervision of industrial waste disposal plants are needed and may have to be met on an industry-wide basis in the future. B.H.W.

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23rd & Locust Sts., Phila., Pa.
BRANCHES
New York Baltimore Washington
See our catalog in Dairy Industries Catalog

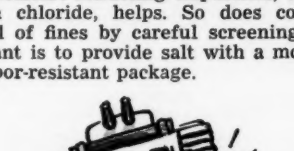
Your advertisement is being read in every State and in 25 Foreign Countries

IMAGINE YOU
WEARING AN ASPHALT RAINCOAT!

● Probably you'd look terrible. But one thing is sure—you'd stay *dry!* For asphalt keeps out moisture. And that's why we use asphalt to help keep Diamond Crystal Salt dry, and prevent caking.

Salt usually cakes in excessive humidity, because moisture condenses on salt particles, forming a thin layer of brine. Then, in dry weather, the brine evaporates and the crystals knit together.

Our research laboratory has found a number of ways to help prevent salt caking. Removal of moisture-attracting impurities, such as calcium chloride, helps. So does complete removal of fines by careful screening. Most important is to provide salt with a moisture- and vapor-resistant package.



Take our Flour Salt bag, for example. It is composed of three 50-lb. and two 25-lb. sheets of kraft, laminated together with 40 lbs. of asphalt per ream. That's a lot of asphalt, and it costs us more money — but our moisture-vapor transmission tests show this bag is worth the extra cost. The bag is even sewn with *waxed thread* to seal the holes made by the sewing-machine needle. That's real *protection* —one reason we have been able to eliminate caking as a major problem!

Want Free Information On Salt? Write Us!

If *you* have a problem involving the use of salt, write our Director of Technical Service. He will be happy to help! Diamond Crystal Salt, Dept. H-13, St. Clair, Mich.

DIAMOND CRYSTAL
ALBERGER PROCESS **SALT**

Penetrates Like a Ghost . . .

The Free-Rinsing Quick-Acting Bactericide!

A brick wall doesn't offer much resistance to the supernatural penetrating power of a ghost. And when it comes to grease film, Diversol "floats" through with superior penetrating power, too!

Yes, Diversol has the unique ability to penetrate quickly, completely . . . invades invisible grease film where food-spoiling bacteria are likely to lurk . . . disinfects equipment thoroughly, yet safely.

In addition, Diversol provides top water softening action . . . leaves no hard water film and scale on equipment to hinder operating efficiency. Complete free-rinsing action leaves glass and metal surfaces bright and shiny.

Next time try Diversol. Let a Diversey D-Man show you its outstanding superiority over ordinary bactericides. Write The Diversey Corporation, 53 W. Jackson Blvd., Chicago 4, Illinois.

There's a Diversey D-Man and a Diversey Product Better Qualified to Serve You

. . . In Disinfecting Equipment • Cleaning Equipment Removing Scale • Removing Milkstone • Washing Bottles • Maintenance Cleaning and Polishing • Standardizing Acidity • Washing Cans • Cleaning and Disinfecting Dairy Utensils • On All Cleaning Operations.

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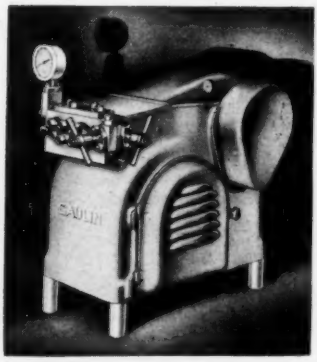
The Standard of the World

The Gaulin Two Stage Homogenizers and High Pressure Pumps have been built by us for over forty years. This background of engineering know how, assures the processor of the finest and most modern homogenizer for fluid milk, ice cream, evaporated, condensed and spray dried milk or eggs, as well as other dairy products. The homogenizers are built in a range of sizes from 75 to 2500 gallons per hour. High pressure pumps are custom built to meet individual requirements. Both types of machines are approved by leading health authorities.



WRITE FOR BUL. 821

MANTON-GAULIN TWO STAGE HOMOGENIZER

THE MANTON-GAULIN MFG. CO., INC.
44 GARDEN STREET EVERETT, MASS., U.S.A.

Orvus, by greatly lowering surface tension, decreases solution dragout . . . speeds cleaning action . . . boosts the efficiency of your alkali solution. Bottles cleaned with this time-tested wetting agent and synthetic detergent come out amazingly clear and sparkling. Re-runs are greatly reduced, *particularly on chocolate drink bottles.* An Orvus solution quickly wets through and loosens hard-to-remove chocolate deposits.

You lose none of the cleaning efficiency of Orvus in hard water. It assures thorough emulsification . . . fast rinsing . . . better run-off . . . dryer bottles. Orvus is easy to use. Economical, too—a little goes a long way in your soaker tanks.

ORVUS

REDUCES BOTTLE RE-RUNS

★

For further particulars about Orvus, write

PROCTER & GAMBLE—P. O. BOX 599—CINCINNATI 1, OHIO

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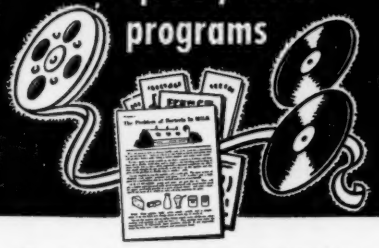
GET

this educational material for quality milk programs



To assist in the production of quality milk at no cost to you, Pennsalt offers a selection of informative films, recordings, literature and other educational material. Hundreds of dairy plants, producer organizations, health departments and technicians have successfully used this material to help dairymen understand the methods used, and to help field men discuss the subject with producers.

In language anyone can understand, it details the fundamentals of quality milk production, makes clear to the farmer that sanitary milk production is inexpensive and fits readily into his regular routine.

You can depend on the authenticity and accuracy of this material, for it has been carefully prepared by the makers of B-K Powder and General Manual Kleanser—two famous products that form the backbone of many quality milk programs. Take action now . . . we'll send full details on request.

Write to Dept. DS B-K Division

PENNSYLVANIA SALT MANUFACTURING COMPANY
Chemicals
1000 WIDENER BUILDING, PHILADELPHIA 7, PA.

WRONG

TO REMOVE MILKSTONE!

Keep It Off Permanently

WITH

NU-KLEEN

"Dairyman's Friend"

IN THE PLANT! ON THE FARM!

Modern sanitation demands that milkstone be eliminated —not by removal—but by KEEPING IT OFF! Regular use of NU-KLEEN, the new synthetic, liquid detergent DOES THIS — QUICKLY! EFFICIENTLY! SAFELY! ECONOMICAL!

And for sure, effective sterilization after the NU-KLEEN treatment, use KLENZADE X-4 bactericide, another product of KLENZADE RESEARCH. Write for details today.

Chemical specialists for the Dairy Industry.

KLENZADE

KLENZADE PRODUCTS

INCORPORATED

BELOIT, WISCONSIN

CHEMICAL CLEANING SPECIALISTS SERVING THE DAIRY INDUSTRY WITH CONVENIENTLY LOCATED BRANCH OFFICES, WAREHOUSES AND DISTRIBUTORS IN PRINCIPAL CITIES THROUGHOUT THE NATION

Your advertisement is being read in every State and in 25 Foreign Countries

BACK COPIES

of

Journal May Be Available

The Association has available back copies of the Journal of Dairy Science. If you need back copies, please write and inquire as to whether the particular one that you need is available. In some cases we have only a few volumes and we do not sell them unless the complete set of volumes is purchased. In many cases we have six or eight volumes complete with 50 or 100 copies available of certain numbers such as the November or December issue.

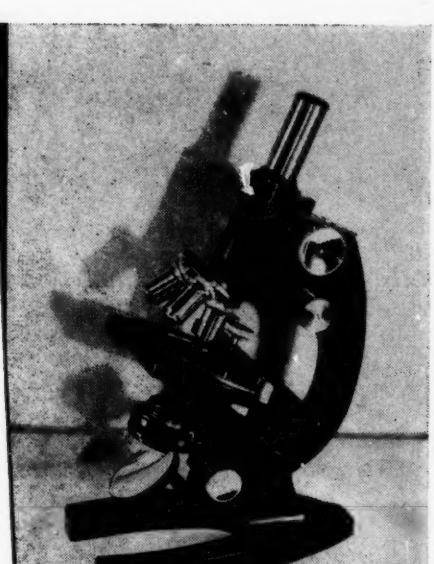
The cost of the first sixteen volumes if available is $5.00 each. The cost of Volumes 17 to the last year is $6.00 each. Individual numbers when available are $1.00 each.

If you are interested in procuring back copies please write to the Sec'y-Treas., American Dairy Science Assn., c/o Ohio State University, Columbus 10, Ohio. Make all checks payable to the

AMERICAN DAIRY SCIENCE ASSOCIATION

Check with

FOR BAUSCH & LOMB DAIRY MICROSCOPE



Today, more than ever, quality control is vital to the success of the modern dairy products plant. One of the most valuable tools for the plant laboratory and the field control man in checking quality is a good microscope specially calibrated for dairy work.

Creamery Package is pleased to offer the Industry the Bausch & Lomb Dairy Microscope (No. 31-21-55-63) specially calibrated for the Breed method of direct microscopic count on milk.

More and more plants are using the Breed Count as a rapid, inexpensive method to evaluate and help improve the quality of their raw milk supply. Using the Breed Count, the Plant Laboratory or the Fieldman can readily count and classify types of bacteria in a patron's milk. Armed with this information, he can constructively help the patron correct the particular trouble whether it is dirty utensils, mastitis, poor cooling or other causes.

For judging homogenizing efficiency—measuring fat globule size and studying dispersion, a specially calibrated eyepiece disc can be supplied.

NOW AVAILABLE FOR REASONABLY PROMPT DELIVERY

The Bausch & Lomb Dairy Microscope No. 31-21-55-63 is illustrated above. It is specially calibrated for 300,000 factor for use in making direct microscopic counts on milk using the standard Breed Count as described in "Standard Methods for the Examination of Dairy Products" published by the American Public Health Association.

The microscope comes equipped with three objectives (10, 43 and 97 power); a standard 10 power eyepiece as well as the special 6.4 power eyepiece for the Breed Count; a mechanical stage for ease in handling the slide; Abbe condenser in rack and pinion focusing mount; wooden carrying case with lock.

Additional lenses and accessories will be available for adapting this microscope to mold counting work in creameries.

CHECK WITH CP

B&L Microscopes Are Sold Nationally to the Dairy Industry by

Creamery Package

THE CREAMERY PCKAGE MFG. COMPANY

1243 W. Washington Blvd., Chicago 7, Ill.

CREAMERY PACKAGE MFG. CO. OF CANADA, LTD., 267 King Street West, Toronto 2, Ontario

DIFCO

CULTURE MEDIA
for Examination of Milk

BACTO-TRYPTONE GLUCOSE EXTRACT AGAR

is recommended for use in determining the total bacterial plate count of milk in accordance with the procedures of "Standard Methods for the Examination of Dairy Products" of the American Public Health Association.

Upon plates of medium prepared from Bacto-Tryptone Glucose Extract Agar colonies of the bacteria occurring in milk are larger and more representative than those on media previously used for milk counts.

BACTO-PROTEOSE TRYPTONE AGAR

is recommended for use in determining the bacterial plate count of Certified Milk. The formula for this medium corresponds with that suggested in "Methods and Standards of Certified Milk" of the American Association of Medical Milk Commissions.

BACTO-VIOLET RED BILE AGAR

is widely used for direct plate counts of coliform bacteria. Upon plates of this medium accurate counts of these organisms are readily obtained.

BACTO-BRILLIANT GREEN BILE 2%
BACTO-FORMATE RICINOLEATE BROTH

are very useful liquid media for detection of coliform bacteria in milk. Use of these media is approved in "Standard Methods."

Specify "DIFCO"
THE TRADE NAME OF THE PIONEERS
In the Research and Development of Bacto-Peptone and Dehydrated Culture Media.

DIFCO LABORATORIES
DETROIT 1, MICHIGAN

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